BULLETS OF THE FAIRWAY OPULAR CHANICS SEPI 25 CENTS SEE PAGE 409



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LC/LP

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And millions of other men keep looking young and fit simply because they keep their faces in perfect condition with Barbasol.

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And finally the bland oils contained in Barbasol leave the skin in perfect condition so that premature wrinkles and old age lines cannot intrude.

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Already it's America's most popular shaving cream.



Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

September, 1935

Vol. 64, No. 3

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A Hobby Worth Money to You

L OOK around your home and note the innumerable articles made of sheet metal—trays, baskets, tables, lamps, bird cages, lawn ornaments and dozens of other pieces. A four-piece metal-working outfit makes it possible for the home craftsman to construct articles of sheet metal almost as easily as though he were building with cardboard. The equipment applies to the home workshop on a miniature scale the same methods used by the factory and offers an interesting and absorbing hobby with many money-making possibilities. Look for the article next month—you will find it illustrated by photographs in natural color.

Next Month

FOOTBALL is just around the corner and the coaches are beginning to issue their mournful predictions. Building a winning gridiron team today has become a scientific process involving a host of mechanical devices from tackling dummies to machines which drill players in charging, blocking and tackling. An article in the October issue describes the latest aids developed by clever coaches.

Flying Cross Heroes

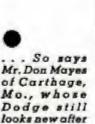
FLYING over San Francisco, an army plane bursts into flames. The pilot orders his companion to jump and the mechanic leaps to safety—but not the pilot. He stays with his burning ship, risking a flaming death high in the clouds rather than allow his plane to descend on the city beneath him. It is for such deeds that Uncle Sam confers the Distinguished Flying Cross. Read next month of the many feats of courage which have won this high honor.

Sit Up, Fido

THERE is no deep, dark mystery about training a dog. Patience and common sense are the principal elements involved. If you have them, and if your dog is intelligent, there is no reason why he should not be taught many interesting stunts. Circus animal trainers tell you how to go about it in an article next month.

Published monthly by POPULAR MECHANICS CO., 200 East Ontario Street, Chicago, V. S. A. Single copy in United States, 25 cents; \$2.50 a year, \$4.00 for two years in United States and possessions, and countries of the Pan American Postal Union; for Canada, Newfoundland and Labrador, add 50 cents a year extra for postage; to all other countries add \$1.00 a year extra for postage. Changes in address must be reported to us immediately to eliminate delay. Entered as Second Class Matter, Sept. 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 2, 1879. Entered as Second Class Matter at the Post Office Department, Canada. Copyright, 1935, by Popular Mechanica Co. in the United States, Australia and France.

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HOW CHEVROLET KNEE-ACTION gives you a more comfortable ride

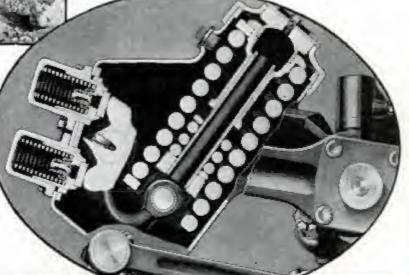


MEN who know mechanics, hardly need be told how Chevrolet Knee-Action works. But they will appreciate the results of Knee-Action every bit as fully as other motorists. Among these results are a

smooth gliding ride for all passengers; added safety at high speeds; and shock-proof steering, which minimizes driving fatigue. Only genuine Knee-Action can give you Chevrolet's splendid Knee-Action results.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN
Compare Chevrolet's lose delivered prices and easy G.M.A.C. terms. A General Motors Value

With Chevrolet Knee-Action, the front wheels are built into the car in such a way that they are free to move up and down independently of each other in fixed paths. Also, the wheels are mounted on soft-acting coil springs which have only one duty—to spring the weight of the car.

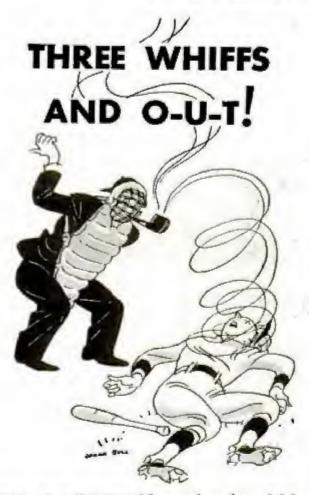




FOR QUALITY AT LOW COST

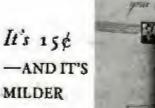
The Master De Lane Chevrolet is the lonestpriced car in the world with the outstanding comfort and safety advantages of the Knee-Action Ride, Try Chevrolet Knee-Action your-self over your own favoriteroad. And choose Chevrslet for quality at low cost.





KILL THE "UMP"? No—reform him. Make him clean out that bad-smelling briar, give up foul-ball tobacco, and turn to Sir Walter Raleigh's pleasanter blend. One whiff of that and you've discovered the hit of a lifetime. We claim this well-aged mixture is cooler on the tongue and delightful to the nose. We insist Sir Walter's milder. But more convincing yet, sales grow and grow as thousands try and cheer the magic recipe for a perfect smoke: "Sir Walter Raleigh and a well-kept pipe!"

Brown & Williamson Tobacco Corporation Louisville, Kentucky. Dept. P-59





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Are You STILL in the DEPRESSION??

TIMES are better. Business is out of Times are better. It the rut—well ahead of a year ago. Millions of men have gone back to work. There's more money in lots of pay envelopes. But what good is that to you, if your pay check is still written in depression figures?

You weren't so discontented a year ago. In fact, you considered yourself lucky to have a job. But now-you have begun to wonder and worry why the oncoming tide of prosperity hasn't reached you yet. The situation is getting desperate. Billscontinue to pile up. You can't get along forever on a "shoe string" budget, You must win back those pay cuts. Other men are doing ithow can you?

Certainly, you can't work any harder than you have been. And it isn't a question of your intelligence, honesty or ambition. Those virtues do not solve today's problem—they are often insufficient to hold down a job, as millions unemployed sadly testify.

But there is a way to get back to the prosperity pay check. A way that's probably far easier than you have dreamed. A plan that has been "depression-tested."

During the worst period of the depression, this plan was helping thousands of men and women forge ahead. Today, during recovery, these same men and womentheir ranks swelled by thousands more-are being picked for top positions. They are escaping years of monotonous, routine service-achieving their dreams while they are young enough to enjoy success in its fullest measure.

Since this plan brings results in bad times as well as



good, it obviously works independently of business conditions. As unbelievable as that may sound, remember that success is largely up to the individual. Most men struggle through a depression all their lives. The few who forge ahead ride to success the same business tides that sweep the majority to failure.

The LaSalle Success-Building Plan is made for men like you-men with courage, ambition, persistence, who need expert guidance to make the most of their efforts. But LaSalle supplies even more than that. Not only individualized training and coaching to help you meet today's crying needs . . . but also the very steps you need to take to fill the job ahead, and force that pay raise quickly. Any

synopsis of this plan, which we might include here, could give you only a vague idea of this service. We suggest you mail the coupon for complete details on your own line of work.

Today's Danger

There's a real danger to accepting "depression pay" these days. A danger that lower wages will continue to dog you-for no employer will pay more until he is convinced you are worth more. Some day, some way, you've got to convince him. There's no time to lose. The sooner you begin, the better.

If the LaSalle Plan has fulfilled this aim for thousands, isn't it logical to expect it can do as much for you? This coupon can easily



LaSalle Extension University

LaSalle Extension University, Dept. 964-R, Chicago

I would like to know about your Success-Building Plan and service in the business field I have checked.

- ☐ Business Management ☐ Higher Accountancy ☐ Traffic Management
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The Purolator Oil Filter has been truly termed, "The Motorist's Savings Bank."

Its deposits are composed of dirt and grit and fine metal particles and hard carbon. Its job is to remove these destructive abrasives from the oil stream—and for about 8,000 miles of driving it keeps the oil pure . . . and clean . . . and effective . . . prevents scored cylinders, worn valves and broken bearings.

But the PUROLATOR must be reserviced

Its reservoir is filled with this destructive sludge after about 8,000 miles of driving. That means a Purolator Filter replacement—and all good service garages will attend to that job in a very few minutes.

Keep your Purolator at work. It will save you oil, repairs and replacements . . . and will add years to the life of your car. Motor Improvements, Inc., Newark, New Jersey, makers of



The Motorist's "Savings Bank"

PUROLATOR

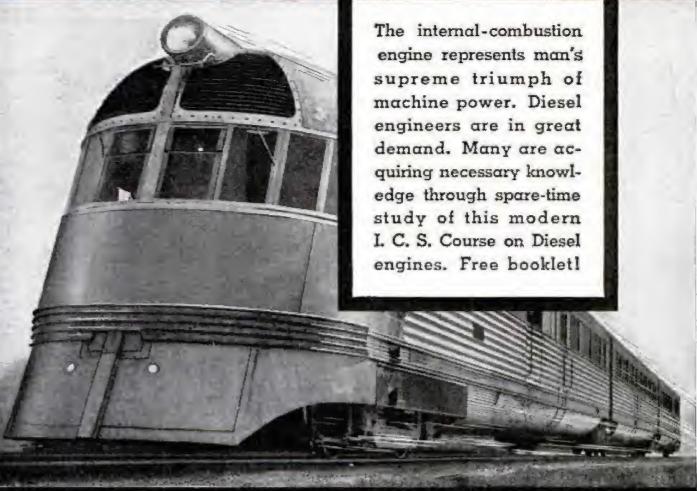
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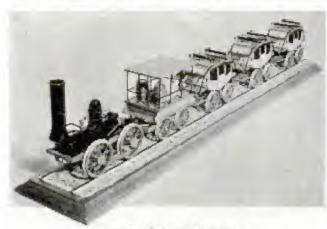


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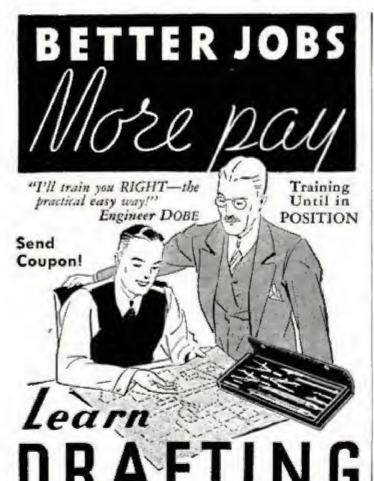
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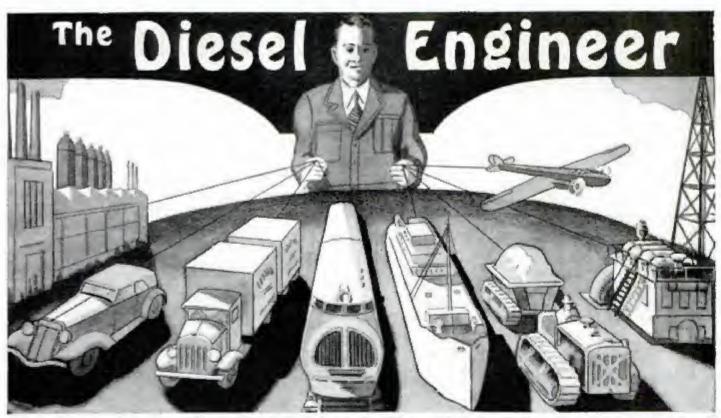
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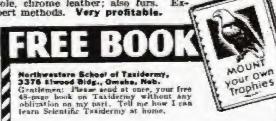
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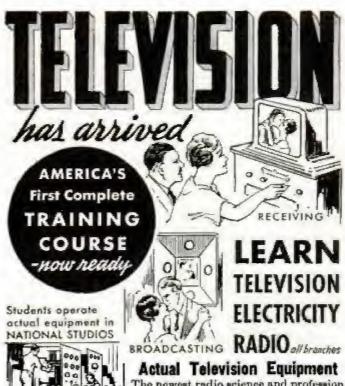
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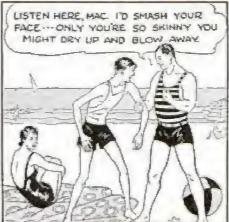
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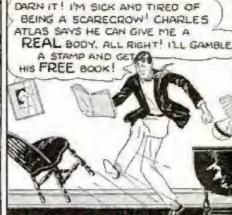


















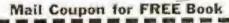
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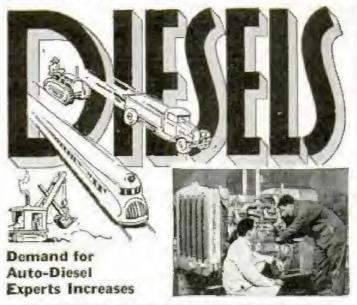
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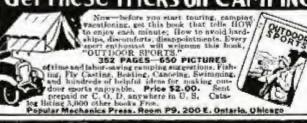
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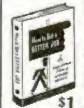


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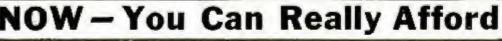
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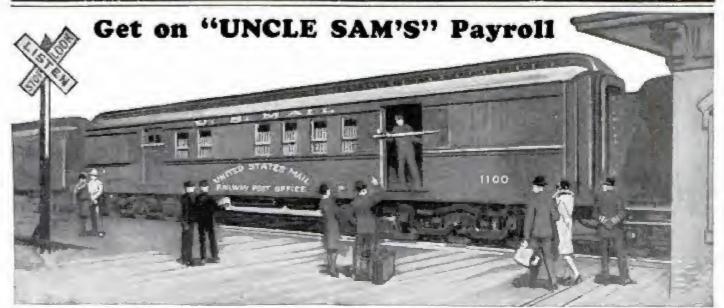
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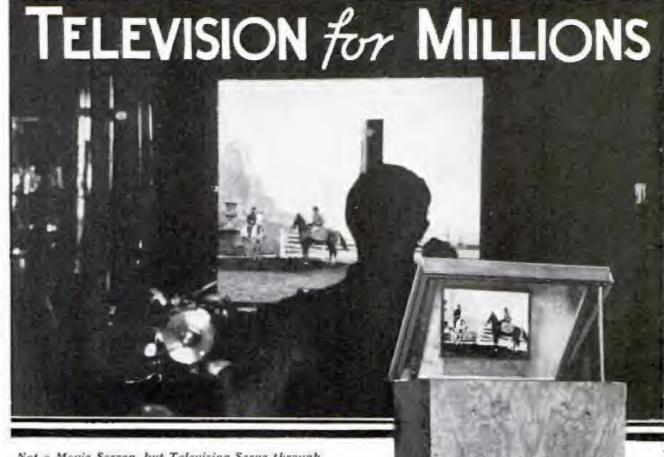
Popular Mechanics Magazine

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 64

SEPTEMBER, 1935

No. 3



Not a Movie Screen, but Televising Scene through Window by Intermediate Film Process

TELEVISION is no longer "just around the corner" for several million people. It is actually available today to those who live in the London and Berlin metropolitan areas, and in a few months will be offered to several other millions living in or near New York City.

The London broadcasts from the Crystal Palace station of Baird Television, Ltd., covering a radius of thirty miles, have achieved a high degree of success with daily programs chosen principally for their artistic and entertainment value. It is a ten-kilowatt station, which has been found sufficient to insure good reception in the thirty-mile radius, but the power soon is to be raised to thirty kilowatts.

More than half the equipment, both for transmission and reception, is of American



Television Receiver Which Produces an Image

Twelve Inches by Eight Inches

321



station, one for sound and one for vision, but only one is needed for the reception of both sound and vision. Three methods of pick-up are used by the Baird station. One is a direct pick-up, in which the television camera is trained upon the scene. The second method is known as the intermediate film process, developed in Germany. In this, the scene is first taken on (Continued to page 142A)

MAP OF SIGNAL STRENGTHS RECEIVED 7 METER, 10 KW. TRANSMITTER THE FIGURES REPRESENT MICROVOLTS

30 MILES

S MILE

TO MILES

CRYSTAL PALACE

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2760(

()2000

2600

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ABOVE 1000 MICROVOLTS A GOOD PICTURE UNDER ALL CONDITIONS 1350 ZS MILES 250 -1000 MICROVOLTS A GOOD PICTURE WHEN THE RECEIVING AERIAL IS NOT WITHIN 50 YARDS OF A ROAD 20 MILES 100-250 MICROVOLTS A GOOD PICTURE IN QUIET LOCATIONS

3310(D)

O1275

O3150

3000

2910

()1230

design and construction. This is made possible because Baird Television. Ltd., and Farnsworth Television, Inc., of this country, have an agreement for a complete interchange of patents and technique. Both companies have a similar agreement with Fernseh, . A. G., of Germany, hence the development of television in Germany, England and the United States is likely to proceed

along similar lines, each company availing itself of the technical advances and developments of the other two.

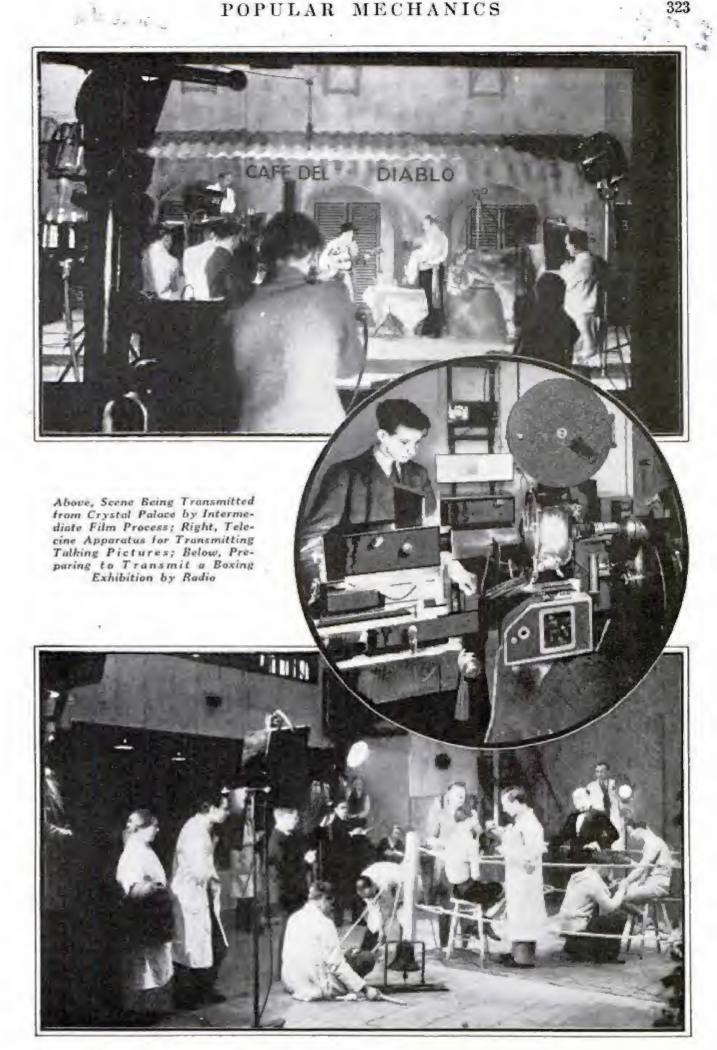
The London broadcasts have had their greatest interference to reception from the electrical equipment of automobiles. but this has been overcome, to a considerable extent, by increasing the power of the station. It also has been found that placing receiving aerials at least seventyfive feet from heavily traveled streets eliminates much of this trouble. Tests have shown that a density of from 500 to 800 microvolts in any section of greater London is sufficient to overcome automobile interference and 1,000 microvolts is enough to insure good reception under any conditions.

Two antennas are used by the London



South Tower of Crystal Palace, Showing Sound Aerial on Balcony, and Map of Signal Strength Received; Bottom, Transmitting Scene

* 1 - 5 -



POPULAR MECHANICS anada

Strange Cargo Rides Skies of Far Northwest



Canvas Bag, then

Skidded Up Gangplank Aboard

Plane Bound for

Isolated Outpost in Canadian

Northwest; Cen-

ter and Bottom. Boilers and Heavy

You can expect anything from oxen to dynamite as fellow travelers when you book a ride over the northwest wilderness on a Canadian Airways plane. The air is the principal thoroughfare in the Canadian northwest, and it pays to fly when the cargo coming back is gold, radium and other minerals from the rich frontier diggings, or valuable furs. There is no other way to reach the isolated outposts in the short summer season. At the air-line base at Oskelanaio one day a man inquired of Pilot Lymburner the fare for flying a pair of oxen to Chibougamou, site of a new gold

strike. The oxen were needed to fill a wood-hauling contract up north. They were roped, wrapped in stout canvas and skidded up a gangplank to the plane. An hour and ten minutes later the ship dropped down at Chibougamou, about 150

Muchinery for Mines Are Transported by Air

> miles away. One ox was a bit air sick. Pigs fly, too. Pork chops came high on the table at Cameron Bay, so the trading post proprietor decided to raise them. A pair of pigs was loaded on a plane for a 1,400mile flight to Cameron Bay, where they

NA STEEL &

were to start a pig colony, and on the same plane were shipped a case of tennis balls, a crate of head lettuce and a bunch of bananas-the bananas selling out at twenty-five cents each ten minutes after the plane landed. Four-thousand-pound cargoes are common on these airways. Forty tons of cement and an engine for a new mine were shipped by air. Here was one plane's bill of lading: five rolls of tar paper, a tin stove, ten cases of canned goods, a barrel of kerosene, two rolls of barbed wire, two bags of oats and five boxes of dynamite stowed among six bales of hay. Pilot Lymburner made several trips to carry eighty tons of dynamite to Dore Lake, 130 miles from the railroad. Six hundred pounds of baby fish were flown north to restock a lake, and were dumped out

while the plane swooped low at 145 miles an hour. Air friction slowed their fall and they pattered into the lake like raindrops. Coming back, the ship brought 2,200 pounds of fish for Chicago markets. Sometimes fur is shipped out alive to start fur farms. Pilot "Con" Farrel, who flew the pigs north, once made a forced landing when fifteen "huskies" broke their leashes and waged a dog fight royal in the cabin, attacking two trappers who were fellow passengers. Fourteen hundred pounds of embattled dogs had the plane wobbling until it skidded to a stop on the ice. Strange cargoes-dynamite, dogs and canoes, sugar and fish, kerosene, cheese and gold.

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.



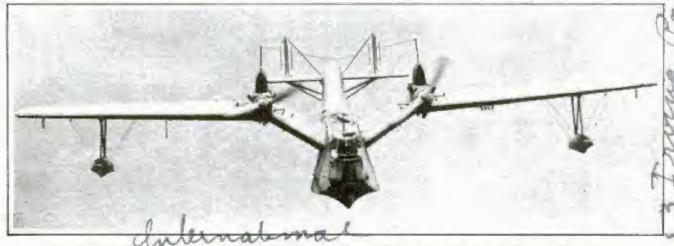
High-Speed Electric Grinder Which Revolves 25,000 Times per Minute, and Set of Accessories for Working with All Types of Material

HIGH-SPEED GRINDER IS USED LIKE A FOUNTAIN PEN

Weighing only twelve ounces, a highspeed electric grinder, which revolves at 25,000 revolutions per minute, is shaped so it can be held and operated like a fountain pen. Its accessories enable the operator to grind, drill, polish, cut, carve, sand, saw, rout and engrave on virtually all types of material. Parts are statically and dynam-(ically balanced, thus eliminating vibration. A special chuck is provided for the accessories, and it can be used in places difficult to reach. Pattern making and wood carving are speeded up and the delicate balance makes possible the carrying out of intricate designs. All types of materials can be given a high polish with the aid of various wheels provided for the purpose, and wire brushes have been developed for cleaning deep cavities quickly. Model makers set up the tool in a special modelmaker's lathe for turning small wood parts for miniature locomotives and airplanes.

POPULAR MECHANICS

British Test Angular "Ugly Duckling" Plane

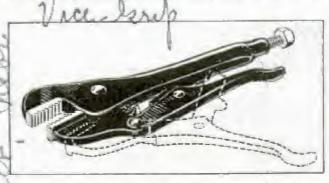


Seaplane of New Type Being Tested for British Royal Air Force; Its Twin Motors Rest at Apex of Wide Angle Formed Where Wings Slant Down to Cabin

"Ugly Duckling" of the Royal Air Force of Britain is the new twin-motored seaplane "R 24/31." Instead of being straight or curved, its wings are angular, slanting down from each engine to the cabin. The body extends back, wasp-like. The ship is being tested at the Marine Aircraft Experimental station in Suffolk.

WRENCH WITH VISE-LIKE GRIP KEEPS WORK FROM SLIPPING

Rounded nuts and pipes that might slip from the hold of an ordinary wrench can be held firmly in the jaws of a vise-grip wrench manufactured in Nebraska. The

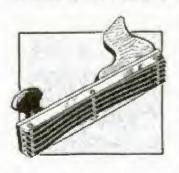


Teeth of This Wrench Will Grosp Round Pipe or Nat Firmly until Lever Is Released

jaws are adjustable up to one and onefourth inches and stay as they are set until
the lever grip is snapped open. The wrench
can twist a half-inch rod, is useful as a
pump wrench to hold a rod while threads
are cut, and is handy in removing corroded
battery bolts, broken studs and screws
with worn slits. Strongly built, it weighs
little more than a pound.

SURFACING TOOL LIKE A PLANE OF IS EASY TO OPERATE

Handled like an ordinary carpenter's plane, a new surfacing tool is effective for removing varnish, smoothing the ends of



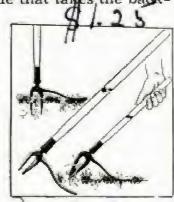
grained lumber and working with fiber and rubber. It has five cutting tooth edges mounted in a rust-proof steel channel, with a hard maple handle. The tool is passed over

the surface in the same manner as a plane. The five blades eliminate the resistance found in working with the plane, giving a smooth follow-up cutting action.

WEEDING LAWN IS MADE EASY. 7 3 9 BY FORK GRIP

Weeds are removed completely and not merely pinched off by an automatic weeder with a long handle that takes the back-

breaking drudgery out of lawn and garden work. The two prongs of its fork are pressed down over the weed and when the tool is pulled back the prongs tighten and pull taproot and all.



metal

POPULAR MACHANICS 327

Secrets of Cellini's Bronze Art Are Revealed



Sculptures as delicate as a rose petal or the hair-like tendrils of a thistle can be poured in molten bronze by the "lost wax" method, secret for 400 years of the famous craftsman, Benvenuto Cellini, and his successors. Guido Nelli, Italian sculptor, has brought to America the artistic secret passed from father to son in the Roman family Nelli since the sixteenth century. First the sculptor's model is covered with molder's clay and the clay coated with a plaster layer or "shell." When dry, the shell is removed, the clay center destroyed and the shell replaced over the model. Liquid gelatin is poured into the space formerly filled with clay. When it is set, the

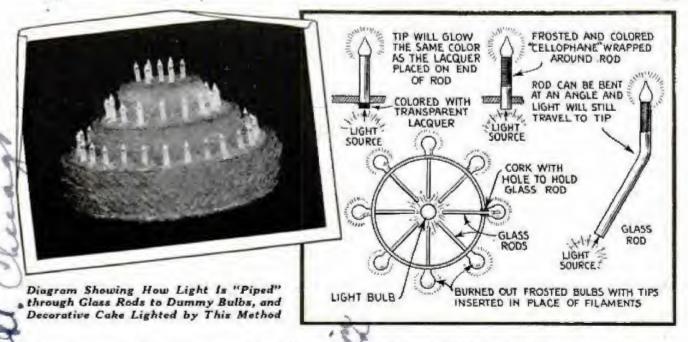
shell is again removed; the gelatin, with its exact impression, is pulled off the model and replaced inside the plaster shell to become the "negative." Warm wax is brushed over the gelatin, and this wax layer, faithfully reproducing the original model, becomes the exact thickness of the bronze in the finished statue. The core is

filled with clay or similar material. Next, cylindrical bars or "gates" of wax are built around the model like scaffolding. Heat at the contact points holds them together. Over gates and all a heat-resistant plaster is laid and when baked in a kiln the wax gates and wax layer around the core are "lost" by melting. Fire-hardened core and plaster outer shell remain, the gates being sempty channels through which molten bronze is poured, filling the space left by the melted wax impression and thus taking the shape of the original model. When the metal has cooled, the plaster cast is removed, the bronze gates filed off, and the statue is finished.

2213 laarnet Los angel

. CO .350 Tax

Light "Piped" in Glass Rods for Decorating

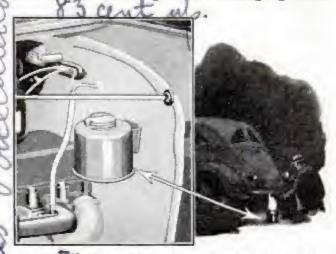


Cone-shaped glass rods instead of miniature electric-light bulbs are being used as an inexpensive method for lighting signs, exhibit maps and for decorative effects. The rods are cheaper to install than? bulbs and are also less expensive to operate since there are no filaments to burn out. The source light for the rods is a regular light bulb placed behind them, its wattage being governed by the number of rods and the area to be lighted. The rods are made of clear, transparent glass; shaped at the light-distributing end so as: to focus the light traveling from the source bulb at the opposite end. The rods can be bent without affecting the diffusion of light at the top, and for color effects the flat ends of the rods can be covered with transparent lacquer. If frosted, the rods will spread light at the sides and this light can be colored by wrapping the tubes with Cellophane. The distance the retracted light travels depends on the diameter of the glass and the wattage of the source light. As many as 100 burned-out frosted bulbs have been illuminated from one source light by inserting the glass tips in the bulbs in place of the filaments.

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

HIGHWAY FLARE FOR MOTORIST WARNS OF STALLED CAR

Warning flares to be posted on the highway behind a stalled passenger automobile or truck at night are now available in the form of a compact unit mounted on a bracket underneath the hood. The motorist finds it equally useful on camping and fishing trips, as well as for illumination and traffic warning while changing tires



Left, Auto Flare Mounted on Bracket; Right, It Lights Repairs and Warns Highway Traffic

on the road. Its burner telescopes into the top, and need only be stepped on to put it out. The burner rises fully primed and is easily lighted. A screw cap prevents loss of fuel when the flare is not in use. It burns ten to twenty hours with one filling of fuel and stays lighted in a sixty-milean-hour wind.





ONE of the Technicolor cameras used by Radio Pictures and Ray Rannehan, the chief cameraman.

PART II

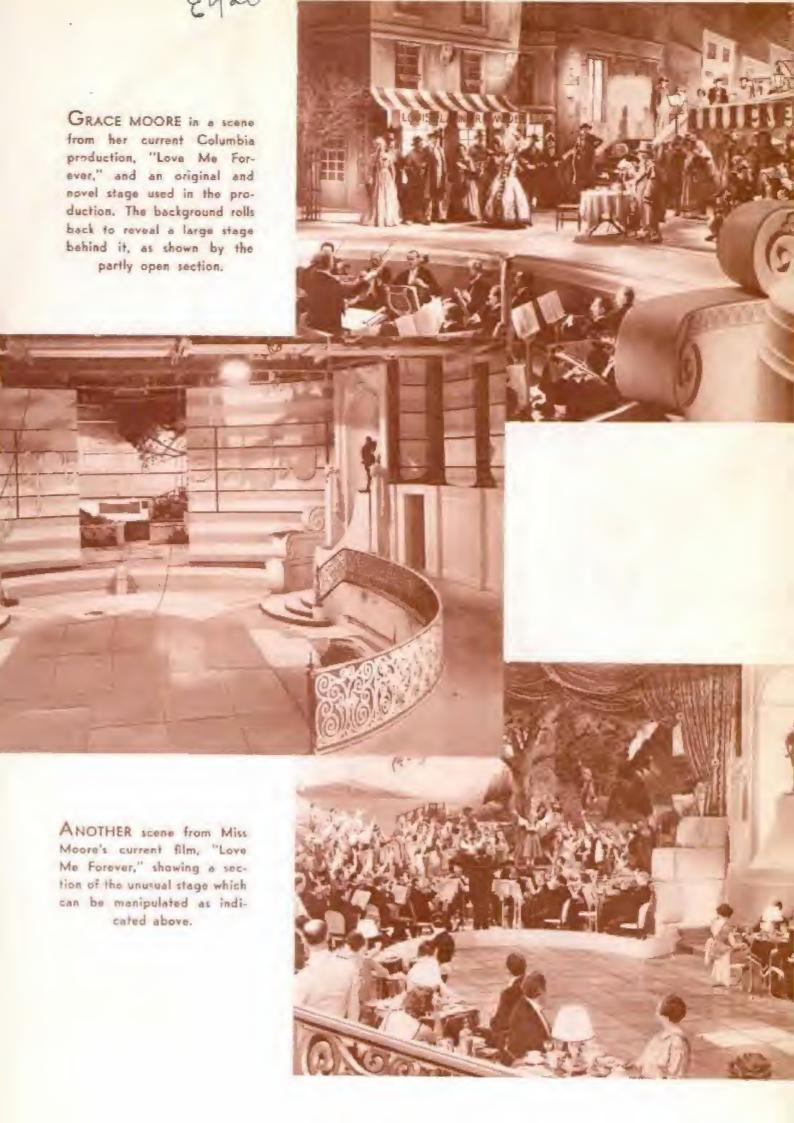
W

E need a moonbeam along which a hundred fairies can dance out of sight into the heavens,"

That was the amazing order Max Reinhardt sent to the technical department of Warner Brothers' studio when he was directing the movie, "A Midsummer Night's Dream,"

And the strange thing is that he got the moonbeam, a path of dazzling light, that weighed seven tons. It was woven from 50,000 yards of Cellophane strands that reflected a million candlepower glow from batteries of lights and was strong enough to support the weight of 104 persons.

Not even the ingenuity of the technical experts could cope with the problem of having the fairies dancing among the twinkling stars, but the cameraman, Hal Mohr, was equal to the occasion. He obtained the effect by blowing artificial cobwebs on a frame, sprinkling it with tiny fragments of silver and then shooting through it.







8420

Ninety per cent of the beauty seen on the motion-picture screen is artificial, created by the tools and brains of Hollywood's expert builders of stage settings and "props," equipment such as the seven-ton moonbeam. So perfect in every detail is the average set that few of the most experienced critics can tell whether an outside scene has been photographed a hundred miles from the studio or in the heart of a sound stage.

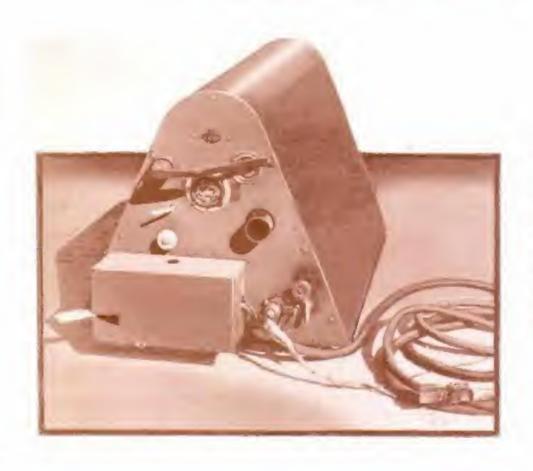
Under the deft touch of the man in overalls, an old whaling boat becomes a racy rum runner in one picture and a battleship in another; a rock-strewn vacant lot becomes a Moorish stronghold; a stage is turned into a rodeo, and the world is made to order between scenes.

And behind these builders, ranging from structural steel workers to silversmiths and miniature painters, are technicians plying sharp pencils to calculate the combined weight of one hundred fairies so that a moonbeam will not crumple in the midst of the big scene, or working out new miracles for the screen.

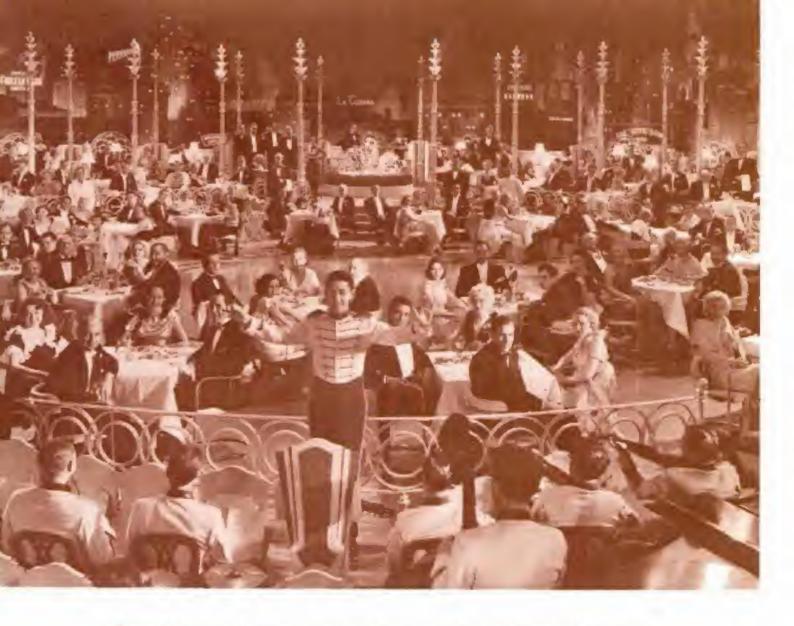
Movies' homemade locations, that bring the outdoors inside the studio, are not always optical illusions created by photographing through painted glass, but are actual steel and concrete structures. Take for instance, the \$75,000 waterfall set in "Footlight Parade," in which a giant hydraulic jack raised ninety-six girls on revolving platforms more than thirty feet up while myriad



STIPPLED screen in position for making a special effect shot for the Warner Brothers' First National production, "Midsummer Night's Dream."



THREE times three guesses would not be too many for you to take in trying to identify this piece of apparatus—and even then you probably wouldn't even come close. It is a fog-making machine which produces a nice mist whenever the script of a Warner Brothers' production calls for



A STAGE setting depicting a roof garden scene with a reproduction of a metropolitan skyline in the distance. Tiny electric signs flash among the silhouette buildings against the sky-drop background.

fountains gushed. It took 300 men, working day and night in shifts of seventy-five men each, five weeks to build this set. And when the scene had been photographed, the jack was dismantled and its component parts put back into the studio's stock room.

Instead of going on expensive "location" trips, the movies are moving indoors for several reasons: first, because of the inaccessibility of unusual locations; second, because of the loss of time in traveling; third, because of better lighting, since the sun not always can be depended upon when a picture that entails perhaps \$50,000 per day is being made; and fourth, because of better sound recording.

The microphone's uncanny knack of picking up foreign noises so common to outdoor locations costs studios literally millions of dollars per year. So the studios would rather build their own "locations." One of them employs forty draftsmen whose job it is to draw plans for stage and lot sets, and 1,500 to 2,000 men to build and operate these sets. Included in this group are workers in practically every science, art and trade, from chemists and sculptors to iron workers and explosive specialists.

For certain sequences in "Flirtation Walk," there was a call for a convincing substitute for a beauty spot in Hawaii. The technical department took over the job and a color drawing was made. Next the director of the department did some close figuring, because the drawing called for an ocean, fishing, a swimming pool, huge rocks with ferns, a running stream, mountains with palm trees, islands, and the correct perspec-



MIRIAM HOPKINS rehearsing a scene from "Becky Sharp," an all-color picture, as the crew stands by, ready for the take.

tive for all. The set had to be made so that a hundred players could blend into the background, doing the things that Hawaiians would do.

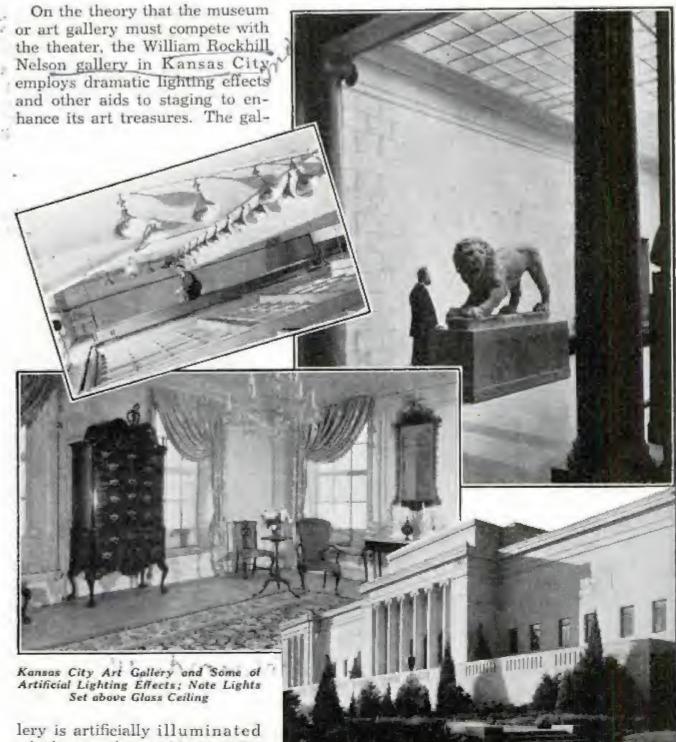
After the drawing was scaled to size, it went to the model room, where it was reproduced in plaster paris, with every contour exact. The model then was cut into strips and the strips were built to set size in shops and on the stage. These sections were built of steel and lumber and reinforced with a two-inch layer of concrete, piped for plumbing, wired for electricity and built to withstand heavy traffic. No chances could be taken, for the lives of leading actors and actresses and of a hundred dancers and extra girls

depended upon the structure's safety.

The cost was slightly more than \$13,000, for ocean, mountains and all effects, not one-third as expensive as one number in "Dames," where a huge turntable, ferris wheel and automatic stairway device was designed to carry eighty girls high over the heads of other players. This odd "prop" was operated by two electric motors through a battery of three automobile transmissions to give forty-two different speeds. It was built of structural steel, ten times the strength necessary.

Skydrops and silhouettes enable the industry to dispense with outside scenery. A (Continued to page 130A)

Artificial Lighting Enhances Exhibits of Art



which not only provides just the proper degree of light for each

exhibit but makes the institution independent of climatic and weather conditions. Neither does the artificial light have the fading and deteriorating effect on paintings, tapestries and other rare materials which natural daylight does. Uniform quality of illumination is obtained by using reflector equipment in an attic space above a glass ceiling. Period rooms requiring the effect of natural daylight are

illuminated by reflected light through false windows. Each week one particular piece is featured and it is displayed in a semidarkened room by directing light on the picture or piece of sculpture in such a ... manner that spectators are aware neither of the source of the light nor the shaft ofthe beam. This is accomplished with the aid of a stereopticon machine with a metal slide placed in an alcove above the ceiling.



Builder Is Shown with Small Motor for Operating Midget Boat by Radio

YOUTH BUILDS TEN-INCH MOTOR FOR RADIO-CONTROLLED BOAT

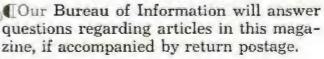
Ten inches long and seven inches high, an aluminum motor was put together by a Venice, Calif., boy in his back-yard workshop. He used molds and castings to construct the tiny engine, spending a year at the task. It was designed for a thirty-nine inch motorboat controlled by radio.

BATHTUB ALARM BELL TELLS WHEN TO TURN OFF WATER

To warn you when the water in the bathtub has reached the proper level, a German manufacturer has devised an alarm bell which is equally useful to check the level of fluids in industrial tanks. A

chromed brass rod
set on a tripod
carries a floater
with an adjustable
sleeve, the upper
end of which closes
an electrical confact when the
floater rises to the
desired water level. It can be connected with a
house bell line or
operate a portable

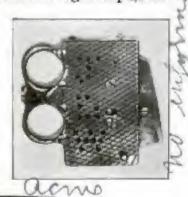
for public baths and hotels, but is also of service in private homes and in factories.



GUN HIDDEN IN PALM OF HAND SHOOTS BETWEEN FINGERS

So small that it is easily concealed in the palm, an automatic pistol of radical design fires its bullet through a barrel between two fingers which pass through loops sim-

ilar to brass knuckles at the front of the weapon. The trigger is a bar pressed by the heel of the hand. Holes in the side allow gas from exploding shells to escape.



STUDENT PAPERS ARE GRADED BY WEIGHING ANSWERS

Examinations are actually graded by weight on a scale devised by Prof. Noel B. Cuff of Eastern Kentucky State Teachers College. The student is given two perforated answer cards with paper between. There are several choices of answer to each test question. The student punches a hole corresponding to the answer he believes/correct. His answer card then is placed over the scales, beneath a group of small weights. Wherever a correct answer appears a weight falls through the card to the scale platter and correct answers are tallied by ounce. This method can check 75.000 questions an hour, save ninetyseven per cent of the time required by the old system of test correcting, and do it fifty to 120 times as accurately.



Weighing the Answers to Determine a Student's Grade on Examination

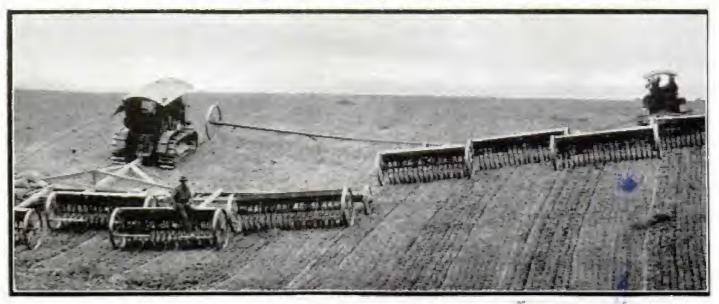
Dusseldorf

Zinc Model Shows Every Detail of Big Dam



Sowing Wheat at a Rate of 250 Acres per Day without Any Undue Human Exertion

FARMING



By CHARLES MORROW WILSON,

A MERICA steps forward into a new age of mechanical farming.

Our newest and most spectacular step is the cotton picker, which can cover an acre in an hour at a cost of about ninetyeight cents, doing the work of about 100 pairs of deft hands and reducing costs of cotton harvest to about one-fifth its present level.

Eli Whitney's cotton gin changed cotton from a trivial garden crop to America's foremost export crop, giving new wealth and employment to millions throughout the world. The harvester, logical successor to the mechanical gin, has come a century and a quarter later.

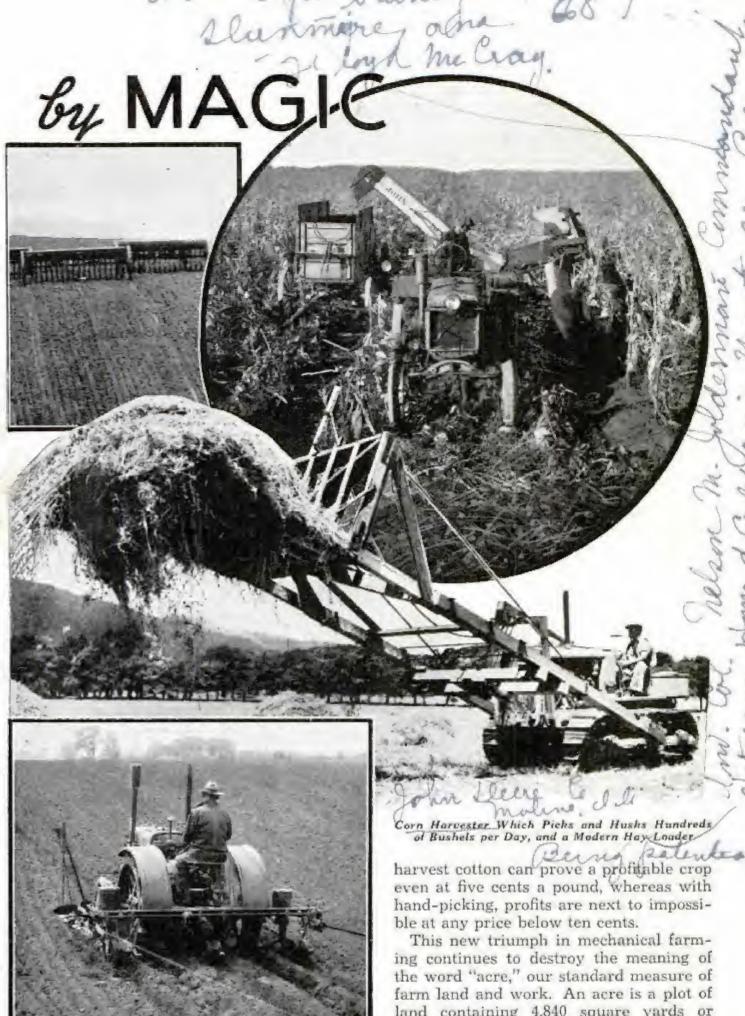
Eli Whitney, a Georgia schoolmaster, is said to have devised the principle of cotton ginning from watching the womenfolks card wool, preparatory to spinning the fabric. John D. and Mack D. Rust, youthful Texans who have produced the new mechanical cotton picker, got the idea watching their old grandmother working her spinning wheel. After extensive picking tests, it is said that with mechanical



Left, Modern Orchard Tractor, Low-Built and Able to Go Wherever a Hoe Can Reach; Right, Rear View of Rust Cotton Picker at Work on a Louisiana Plantation

John Dand

mach Rusti

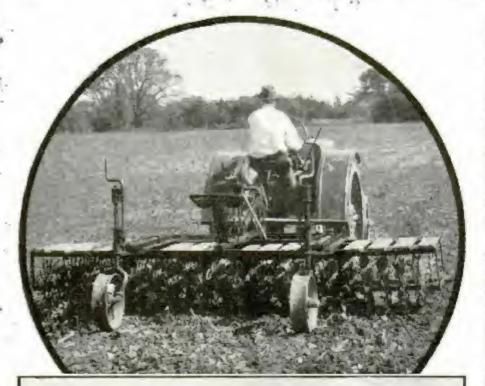


Planting Corn the Modern Way—Thirty Acres in a Seven-Hour Day and No Sore Feet

n Harvester Which Picks and Hushs Hundreds of Bushels per Day, and a Modern Hay Loader

harvest cotton can prove a profitable crop even at five cents a pound, whereas with hand-picking, profits are next to impossi-

This new triumph in mechanical farming continues to destroy the meaning of the word "acre," our standard measure of farm land and work. An acre is a plot of land containing 4,840 square yards or 43,560 square feet; about four times the size of an average residence lot. But originally an acre was the amount of land that





as tobacco, cabbage, tomato or pepper, sets them at evenly spaced intervals, covers the roots snugly with soil, waters them, and drops fertilizer to insure the plants good growth, all at one operation. This machine does the work of between forty and fifty men with superhuman accuracy.

Since the dawn of agriculture, men have planned to plow before they plant. But the newer machines do plowing and planting at a single operation, as in the case of the newly developed disk drill, wherein revolving steel disks pulverize the soil, and behind each disk, connected to a gravityfeed seed box above, is an automatic seed dropper. The weight of the disk drill is carried on two low-set wheels, and each

a man and two oxen could plow between dawn and dusk. Then horses came into use and King James of England decreed that the acre be described in feet and rods.

Even with horses, an acre stayed the practical measure of a good day's work on the farm. To plow an acre with a single plow ten inches wide a man must walk at least ten miles, and he needs a certain amount of time off for hitching and turning. But today there are types of plows with which one man can turn as many as 200 acres in one day. Such is the new magic of farming.

Probably the most widespread increase in farm mechanics at the present time is in planting. We have recently seen the arrival of the transplanter, which automatically takes any kind of young plants, such Top, Rotary Hoe Which Weeds Forty-Five Acres per Day and Answers the Farm Boy's Prayers; Center, Harvest Combine Which Handles 2,000 Bushels of Grain per Day; Below, Automatic Potato Digger

wheel is geared to transmit power to the adjacent half of the thirty-foot line of disks. Six groups of eight disks each are controlled by separate lifting levers, by means of which the mechanism can be protected from rocks or stumps.

When drawn by a fast tractor the work capacity is from fifty to sixty-five acres a day. And for use in dust-storm areas, where plants, even seed, are literally





Top, Power Sheller Which Shells Two Tons of Corn in a Forenoon; Below, Power Hoist Saves Farmer's Back

blown out of the ground, there has been made a press drill with low-set metal wheels that follow each disk and pack the earth firmly over the seed. Where revolving steel disks are not well suited to breaking the soil, blunt plows or furrowopeners shaped like shoes are interchangeable. These plows are "spring-trip," that is, set on springs which yield whenever the point meets an obstruction; then having passed the root or rock, force the point back into place. Mechanical seeding is more economical than broadside sowing, and trials conducted by the department of agriculture indicate that mechanical drilling increases grain yields from three and one half to five bushels to the acre.

For corn, which is still the greatest of all American crops, the double-row "lister" breaks soil and plants at a single operation. Drawn by four horses, a lister breaks the ground and plants the corn at the rate of about an acre an hour, and when tractor-drawn, the speed can be approximately doubled. Each of its two deep-set plows is followed by a pair of pulverizing disks and above each set of rotating disks is set a mechanical corn dropper, which is so placed that the corn seed has a short straight drop into the seed beds opened by the plows and covered by the rotating disks.

An efficient corn lister does the work of from eight to twelve plowmen. But the fastest coverage of land is possible by means of the flexible "pipe-bar" harrow. If tractor drawn, this device can prepare land for seeding at the rate of 200 acres a day.

Anyone who was raised on the farm is apt to remember the backaches and hand blisters that came of hoe wielding. Therefore he may find comfort in noting the new mechanical hoes, which can easily weed forty to eighty acres in a day, ruin all weed growth while the sun is shining, do the work of forty hoemen and replace mortal weariness with mechanical accuracy and speed. The mechanical hoe is truly the farm boy's dream come true.

(Continued to page 132A)

POPULAR MECHANICS



Locomotive Powered with a Gasaline Engine Hauling Cars of Grapes over Narrow-Gauge Railroad from Vineyards to Crushers in California

SMALL RAILROAD HAULS GRAPES FROM VINEYARD TO CRUSHERS

Grapes are hauled from the vineyards to crushers at Guasti, Calif., over a narrow-gauge railroad eighteen miles long which handles no other commodities. Originally a little steam locomotive was used for power but it has been replaced by a gasoline engine. The V-shaped dump cars tip their loads automatically.

GLASS KEEPS OUT HEAT OF SUN BUT LETS IN LIGHT

Plate glass has now been developed which lets seventy to seventy-five per cent of the sun's light pass through but absorbs much of its heat, transmitting less than forty-three per cent of the solar heat to the room. This glass also admits less than twenty-eight per cent of the infra-red rays and virtually stops the ultra-violet rays. This makes it valuable for school windows in warm regions where light without heat is needed. It is also useful for factory windows where heat is inconvenient or dangerous, and for plants and warehouses

where the sun's rays might bleach or otherwise harm textiles. It is not an insulating glass except in absorbing solar rays. The panes are one-fourth inch thick.

STROKE OF GOLFER IS ANALYZED BY RECORDER

Golf strokes can be analyzed accurately by employing an automatic recorder which shows on a dial the vardage a ball would have traveled with a corresponding stroke on the fairway and also indicates whether the play er has hooked or sliced and the extent of the deflection. The recorder is a compact unit which fits into a small suitcase. A button operated by the foot resets the dial after

each stroke and places the ball in position.

Any type of club can be used. By adding a coin attachment, the analyzer can be employed in amusement parks.



This Automatic Recorder Analyzes Your Golf Stroke, Showing Yardage and Whether You Hooked or Slived

Colder Ice Made in Ribbons Is More Efficient

Colder and more efficient forms of ice in both flakes and blocks are the latest developments of refrigeration. The ice comes from the machine in a series of frosty white ribbons that are about one-eighth of an inch thick and which break into irregular wafers as they fall on metal trays. Ten degrees colder than ordinary ice, the flakes present no sharp points to injure delicate foodstuffs. One ton of flakes will do the work of about one and one-fourth tons of





Top, Using Ice Flakes; Center, Left, Ice in Ribbons and, Right, in Blocks; Bottom, Machine for Producing This Ice of Lower Temperature

cracked ice. The same machines, with slight changes, will produce the new blocks, made from freezing twenty-three per cent so-dium chloride and nearly seventy-seven per cent water, a brine. The solution is frozen into ribbons and then compressed into snow-white blocks that are intensely cold, having a melting point of six degrees below zero. The blocks, being so cold, are

not for using in beverages or food, but can be used in food cabinets, storage boxes, railroad cars and trucks engaged in moving large quantities of ice cream, milk, meats, fish and other perishables.

■Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Union cir Terminal Los angeles Caly GHTS on in the Tiny Balls and Pin Points of Light behind the Squares of a Localized Airport Map By DON BLACK

IF an air-line dispatcher could watch on a big map the progress and momentby-moment position of every plane in a great coast-to-coast transport fleet speeding across the nation . . .

If naval officers on a similar map could spot the approach of submerged enemy submarines, could thus visualize the onrush of swift destroyers in heavy fog or of other surface craft in inky darkness...

If the high command in Washington could follow on another such map the progress of hostile air squadrons across the Atlantic or Pacific, know precisely the number of planes flying toward our shores and exactly where to intercept them with defense craft of overwhelming strength...

If such a magic mirror of the heavens were available, it requires no stretch of the imagination to perceive how vital such a facility would be to the safety of air transportation and to our national security. Such a prospect is by no means visionary. It is a virtually accomplished fact if claims for a revolutionary new device are borne out by the striking success of initial experiments.

This instrument, known as the "Spitz flight recorder," is the invention of Dr. Samuel Spitz, retired navy commander, whose ocean sounding "marimeter" is now standard navigating equipment on navy and merchant marine vessels.

Dr. Spitz already has invested more than \$25,000 on his recorder, which has been developed at Union air terminal, Los Angeles. Here, for more than two years, the inventor and his assistants have been working out the practical application of sonic principles to the exact moment-by-moment location of speeding aircraft. In

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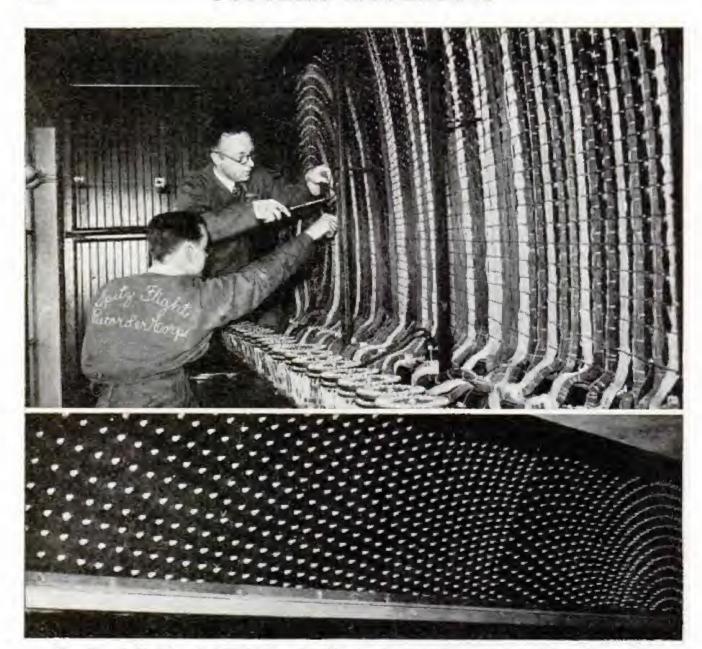


flight experiments conducted by Jim Kinney, of the department of commerce, Dr. Spitz and his operators were able to follow on a small localized map the progress of Kinney's plane flying at random over towns and landmarks miles distant.

In his determination of a plane's position, Dr. Spitz utilizes the sound of its propellers. Picked up by two small microphones, weighing less than five pounds, in the cockpit, these sound vibrations are relayed by the plane's regular radio telephone transmitter to ground stations. In the airline dispatch room they are converted into audible sound. During the process the sound vibrations operate an electrically controlled mechanism actuating an intricate system of tiny lights be-



Top, Spitz Flight Recorder with Inventor at Voice Transmitting Microphone; Below, Divergence Wave Meter Which Shows Distance of Radio Signal from the Flight Recorder's Location



Top, View behind Board of Flight Recorder, Showing Intricate Wiring System; Below, Airway Map Partly Lowered to Expose the Bulb Lighting System Back of It

hind a large-scale translucent map of the particular area in which the plane is flying. Thus on the experimental board of the Los Angeles-San Francisco commercial airway there are more than 3,000 lights and squares for the 335-mile route, each representing one square mile. The inventor says there is no limit to the number of craft whose movements may be recorded, but his present apparatus is equipped to handle sixty-three airplanes.

There are three unique instruments around which the apparatus is centered. One is an automatic tuning device which is integrally a part of the ground station short-wave receiver which converts the propeller vibrations into audible sound. Another is the "binural indicator," whose function is to determine accurately the di-

rection from which the plane's signals are coming. While of the same basic principles as a department of commerce radio beacon, the binural indicator embodies some notable advances over the familiar "beam."

Most extraordinary of all is what Dr. Spitz designates as a "divergence wave meter" which fixes distance away of the emanating plane signal, a hitherto unknown quantity. Here the inventor has applied the principle that spherical waves of sound diverge radially from the source of origin.

"Suppose," explains the scientist, "a transport plane leaves Los Angeles for Salt Lake City, Cheyenne, Omaha, Chicago. Its progress across the Mojave desert, over Boulder dam and alongside the towering Wasatch mountains would be recorded mile by mile by the lights behind each square of our map and at all times under the watchful eye of the airline dispatcher.

"Let us assume that the weather is thick, that clouds obscure the ground, that the mountain peaks are fogshrouded. Flying by instrument alone the pilot gets slightly off course. This divergence would be noted instantly by the ground operators at both the point of dispatch and at Salt Lake City, the immediate destination. One or both promptly would notify the pilot by radio telephone. They might



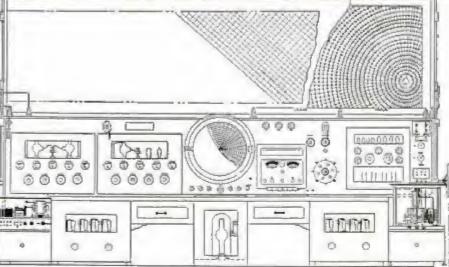


Diagram of Recorder and Part of Wiring System to 3,000 Lights behind a Five by Twenty-Foot Map of the Los Angeles-San Francisco Airway

also warn him that unless this course was corrected and unless he was flying at an altitude of 10,000 feet a dangerous peak of known height loomed in his path.

"Again, suppose conditions are clear and unlimited but that motor trouble makes it advisable for the pilot to land where there is no ground communication. Assuming furthermore that the plane's radio equipment is inoperative, and you have an emergency in which the flight recorder renders exceptional service. When the plane stops, so does its light which remains lit and stationary on the map board. Thus the dispatcher knows to within a square

mile exactly where to send his relief plane."

Dr. Spitz's plane dispatcher can direct aircraft to an airport in bad weather by simply switching his instrument to a supplementary map showing the immediately contiguous area on a scale of feet instead of miles.

Instead of attempting to inform the pilot by telephone after listening to the overhead motors, the dispatcher merely reports to the pilot that his plane

is in "Square 16" or some other equally definite sector on the localized map. By reference to a similar map in his cockpit, the pilot knows exactly where he is at any moment.

Although Dr. Spitz has not divulged how his instrument may be adapted to the location of enemy planes and seacraft approaching our shores, he claims it is as practical a further development as the successfully demonstrated flight recorder. He has already developed a sound-receiving apparatus to pick up sonic vibrations from planes thousands of miles away and record them in map positions.

"Talking Ship" Uses Radio Instead

DJUSTING NETWORK AND BALANCER Room; Diagram Shows Circuit of "Talking Ship" sent his voice over the steel hull to loud-

Use of the ship's hull as a circuit to carry the voice of the captain from the bridge to passengers and crew by means of loudspeakers is the latest development in communication at sea. The method was successfully demonstrated on the steamers "Colombia" and "Pastores" of the Colombian line. Turning a switch and talking into a portable microphone, the captain

LOUDSPEAKERS

I'm les Francis d' Solderles

17 Battery

Top, Lifeboat Drill Is Carried Out under Directions from Bridge by Loudspeakers, Simulating Conditions of Emergency; in Circle, Passenger Adjusts Life Belt with Steward's Aid While Listening to Instructions from Captain over Loudspeaker in Stateroom; Left, First Officer Peter Stolt of S.S. "Pastores" Calls Commands into Portable Microphone on Bridge as Loudspeaker Brings Him Messages from Engine

speakers located in engine room, staterooms, steering-control room, lifeboat deck and other posts throughout the vessel. Another switch allows him to speak over ordinary cables to the crew if he wishes to cut out the passenger cabins. With the entire hull as circuit there would be no breaking of communication in case of collision. If the ship's current fails, storage batteries are automatically connected. The loudspeaker in the engine room acts as microphone for the crew in addressing the captain on the bridge.

FINE ETCHINGS

Easy with Celluloid Plates

A NYONE can easily create fine etchings with a little training by following the methods used by June Constable, great niece of John Constable, the famous English artist. Called neography, the new method can be used for producing striking bookplates, greeting cards, or wall hangings.

The process is virtually the same as in etching on copper, except that transparent celluloid is used. This allows a beginner to lay the celluloid sheet directly over a snapshot, pencil sketch, or illustration and cut a lifelike tracing directly into the material.

tails. Simplified tools that include a special etching knife and a needle-like dry point are used. Several tools and steps in ordinary

etching are eliminated although a

number of effects not available in



Inking the Thin Celluloid Plate before Transferring Impression to Paper, a Landscape Etching Made in Less Than Two Hours, and the Four Simple Steps in the Process







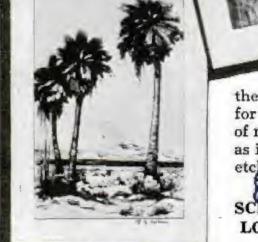
Above, in Finished Proof, the Artist Has Eliminated the Figures on Original

copper etching may be obtained.

Ink is wiped into the lines of the finished celluloid plate and the plate is then covered with dampened paper and is run through a small etcher's press, which transfers the ink from the plate to the paper. In lieu of a special press, fairly good impressions can be obtained by using a clothes wringer equipped with hard rollers. Although regular grades of etching paper produce the best results, good prints can be obtained on silk, canvas, and even heavy wrapping paper. As many

proofs can be pulled as with copper plates, it is claimed.

Sharp, distinct lines or soft, lithographic effects may be produced at will and aquatinting and mezzo-tinting are greatly simplified by the process. As many colors as desired may be applied directly to parts of



Etching of Dog Traced Directly from Snapshot, Desert Scene Reproduced from Pencil Sketch, and Placing Damp-Proof Paper over Inked Plate, Preparatory to Running through Etcher's Press in Making Celluloid Etching

the plate at the same time for color etchings instead of reprinting for each color as is necessary in ordinary etching work.

SCHOOLS OF FISH ARE LOCATED WITH ECHO RECORDER

Echo-recording apparatus, such as ships use in making soundings of depth, can also be employed in locating schools of fish for commercial purposes. A

Norwegian fisheries scientist observed that sound waves sent from a ship's bottom were reflected from the backs of fishes in large schools just as the echoes bounced back from the rock or mud bottom. It is expected that information of this kind will be of importance in conservation work.

escar suno

Illuminated Map Covers Round Glass Room



Photo Courtest Christian Science Monitor

Six Hundred Sections of Glass Curved to Form a Huge Globe Make Up This Map of the World; Light

Shining through from Outside Throws Land and Sea Areas into Bold Color Contrasts

Thirty feet in diameter and built to a scale of one inch to twenty-two statute miles, an illuminated spherical room permits the visitor to view the map of the earth from the inside. The room is covered with more than 600 sections of glass cast in proper contours, painted in correct colors and fitted into the bronze frame, the sections of which comprise latitude and longitudinal lines representing ten-degree intervals. The curvature of the globe corresponds to that of the earth. Illumination coming from outside the globe produces a surprising effect of glowing colors, with each country, each body of water and other features of the earth's surface sharply defined. The visitor stands on a narrow strip of carpet that protects the glass "runway" in the room, with the north polar star shining directly overhead and

the Weddell Sea and the Antarctic region some twelve feet beneath the runway. Painted instructions, occupying the ocean spaces, tell the story of the room, called the "mapparium." Clocks on the equator show the time around the world. The illuminated map is a feature of the Christian Science Publishing House in Boston.

BODY OF MAN HOLDS LESS IRON THAN WEIGHT OF A NICKEL

You need only three thousandths of an ounce of iron in your daily diet to maintain the body supply of that element. Dr. Walter A. Bloedorn, professor of medicine at George Washington University, estimates the iron in the human body would make a slug weighing a little less than a five-cent piece.

ne derige

FIGHTING FIRES



A N exciting job combining the thrills of a fireman's Life and those of a news cameraman has been developed by S. H. McElroy, of Chicago, out of a hobby,

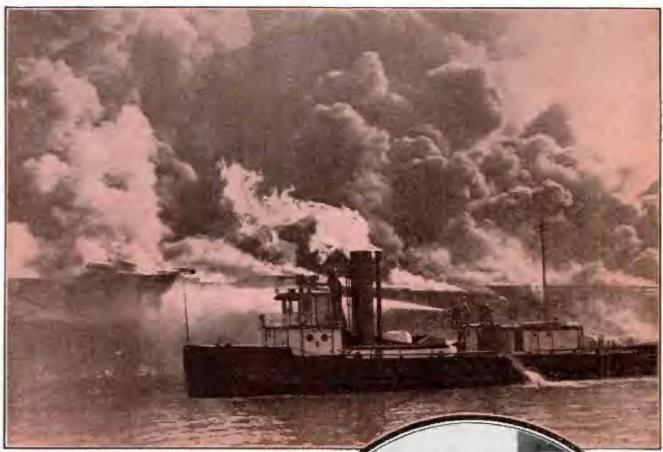
He is engaged in the hazardous task of taking pictures of fires for use in educating the public in their prevention, and for the settlement of insurance claims involving litigation,

A few years ago, this Chicago radio engineer was just a fire fan. Even in the middle of the night the sound of sirens and bells would send him flying into his clothes and out of the house in mad pursuit. There was too much lost motion in this system,



Above, Firemen Battling a Difficult Blaze; Below, Fire Photographer Making Picture of a Factory Blaze from the Rear of the Fire Truck in the Center of the Photograph

with PHOTOGRAPHS



however. Frequently, the sirens and bells would be out of hearing before he could give chase. He decided to improve on his hitand-miss method of attending fires. He struck up an acquaint-ance with the men in the fire-alarm office and they obligingly telephoned him whenever the report of a promising fire was received.

But still he wasn't satisfied. The views of fires from police lines were often hardly worth the bother of coming. And it rankled him to see newspaper photographers and reporters nodding their way past the sentries. So he decided to take pictures too. At the next big fire, McElroy brought along a

regulation size news camera and used it to brush his way past the policemen. He snapped a few pictures to give his "act" the authentic touch. When developed they turned out so well he decided to make



Fire Boat Fighting a Railway Yards Blaze; Below, S. H. McElroy, the Fire Photographer, in His Office

more. After a year's experience in picturetaking coupled with an intensive study of fires, camera angles and lighting, McElroy became very proficient. Most of the prints he gave away to admiring firemen and



This Picture, Which Brought Out the Force of an Explosion in a Restaurant, Aided in Sending Two Fire Plotters to Prison; the Third Man, Who Set Off the Blaze, Lost His Life



Note the Evenly Burned Walls Indicating They Had Been Sprayed with Some Combustible Liquid; the Man Who Started the Fire Confessed after This Picture Was Presented



Plot Nipped in the Bud; the Wind from an Open Door Extinguished a Fuse after the Plotters

Left the Gasoline-Soaked Premises

friends, until one day an insurance company inquired about some pictures he had made. When he sent the company the pictures, it forwarded a substantial check. When several other insurance companies made requests for other pictures, the commercial possibilities of his hobby dawned on him.

Now it's no longer a hobby with him. In addition to pictures for fire-prevention purposes, McElroy photographs thousands for risk firms. He has large files of fire pictures with which he services the adjustment companies representing insurance companies. His negatives are so important they must be stored in a fireproof vault and his darkroom and studio equipment could pass for those of a metropolitan newspaper.

His photographic tools are the finest that can be obtained. For detail pictures, he uses an eight by ten view camera and a news camera for fast action stuff. He has a wide variety of lenses, filters, and infra-red plates, the latter being used when there is a small amount of smoke or fog hovering about the scene. In making pictures where time is not an important consideration, he uses his 500 feet of cable and

floodlight equipment.

His studio in his apartment is equipped with the regular fire-alarm apparatus found in engine houses. He receives a record of every alarm turned in, either by telephone or at the boxes. At night, the alarm system is wired to an apparatus in his bedroom so a gong is struck from one to five times, depending on the type of alarm sent in. Just like a fire chief, he drives a special red roadster with siren going when on official busi-



ness. McElroy has learned to take pictures that will carry weight in fighting a dishonest fire claim. Of course, arson cannot be proved by photographs but they can be of great assistance. One authentic picture of a suspicious fire can give a jury a better idea of it than an hour's description by a lawyer. In several cases, dishonest persons either have been exposed or have confessed when their alibis were discredited by pictures made right after the fire was out, or before.

His pictures aided in bringing to light a several million dollar arson ring in Chicago. One woman fainted on the stand when photographic evidence was adduced to show the fire in her apartment was of incendiary origin.

How can a picture aid in fighting a dishonest claim? There are many ways. For example, the photographer recently attended a fire in an elaborately furnished apartment. When the chief asked for an investigation by the fire attorney, McElroy considered this sufficient cause to make pictures of the apartment for the adjustment company. He noticed walls and woodwork were evenly burned, so he made a shot of each wall. As a result, the claim was not paid because the pictures

Above, Originating Point of Disastrous Chicago Stockyards Fire; Below, House Wrecked by Gasoline Explosion

helped to prove the fire to be the handiwork of an incendiarist. If the fire had originated naturally, it was pointed out, some corner of the room would have been burned out. The pictures indicated the walls had been sprayed with gasoline and the defendant admitted that fact later.

In another case, pictures were introduced in a claim suit to repudiate the statements of the owner of the company that had been partly damaged by fire. Evidences of a "flasher," a knotted strip of newspapers laid around the baseboard of the room to expedite the spread of flames, were found when the blaze was extinguished shortly after it had started. Pictures of this room, of the basement free of

(Continued to page 125A)

GERPRINT VISIBLE ON CLOTH BY SILVER-NITRATE PROCESS



Palm Print Brought Out on Cloth by Chemical Treatment Is Plainly Seen under Sun Lamp

By treating cleth, paper and similar substances with a silver-nitrate process it is possible to bring to light fingerprints heretofore invisible. After the special treatment, the material is held under a sun lamp and telltale imprints are seen plainly. The discovery is expected to be valuable in crime detection.

GROUND SPEED OF AIRPLANE MEASURED BY, PENDULUM Intended to record the ground speed and

the distance traveled by an airplane in much the same manner as a speedometer serves a motorist, an automatic groundspeed indicator has been produced by a Texas inventor. Essentially, the device is operated by a weight which swings backward or forward as the speed increases or decreases. The position of the weight in turn controls the position of a friction wheel on a disk which regulates the "speedometer" on the instrument panel. It is claimed the speedometer,

records actual distance traveled and actual speed of travel much more accurately than the usual air-speed indicator which is not very reliable when

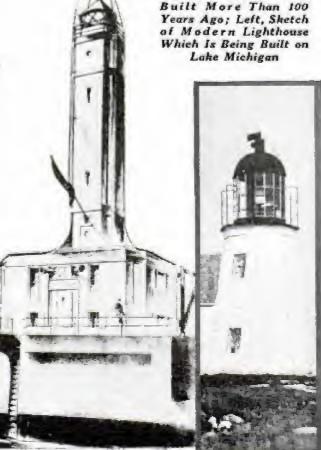
flying against a headwind, for instance. The equipment, which weighs only twelve pounds and is contained in a box nine by nine inches, can be located anywhere about the ship. A governor-controlled motor, run by the plane's battery, is the source of power which motivates the disk while the weight, which swings much like a pendulum, determines the position of the friction wheel. When a ship is ascending, only the forward motion, and not the climb, is shown. 492

LATEST IN LAKE LIGHTHOUSES FAR AHEAD OF EARLIEST

To replace the Gray's Reef lightship on eastern Lake Michigan, the latest thing in lighthouses is being constructed. It has the most modern equipment, including apparatus for automatic operation of the beam. In comparison, the Race Point, Mass., lighthouse, constructed in 1816, had only a

> stationary oil-burning lamp and other equipment of that time. The Race Point lighthouse was one of the first built in this country.

Right, Below, Race Point Lighthouse Which Was Lake Michigan



Autogiro Port on Roof May Speed Air Mails



Architect's Drawing Shows How Roof of Post Office Building Could Be Rebuilt as Landing Field for Autogiros Supplying Shuttle Sprvice for Air Mail Between Newark Airport and Downtown New York

Conversion of the roof of the New York Parcel Post building into a landing platform for autogiros has been proposed with the purpose of speeding transportation of air mail between downtown New York and the Newark airport. Planes could cut the transit time from an hour to ten minutes. An architect's plan calls for a 200 by 750 foot surface to be built at an estimated cost of \$1,000,000. Similar projects have been suggested for other large cities.

FORESTS STORE SUN'S ENERGY FASTER THAN COAL IS USED

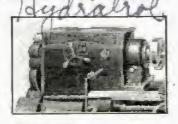
More energy is absorbed from the sun and stored away in American forests than is expended every year in coal mined. Dr. Hardy L. Shirley, of a forest experiment station at St. Paul, estimated that every acre of white pine in Wisconsin annually stores in wood, bark and leaves the equivalent of a ton of coal in solar energy. On

that basis forest lands of the entire country, 670 million acres, capture energy equal to 1,403 million tons of coal, two and one-half times the tonnage mined in 1930.

LATHE SPEED CHANGED QUICKLY WITH HYDRAULIC CONTROL

Instantaneous change of speed, both forward and reverse, is made possible in a lathe equipped with hydraulic clutches and brakes. The lathe has sixteen speeds for-

ward and eight in reverse, controlled by a three-lever handle which can be turned without intermediate stop to the desired ve-



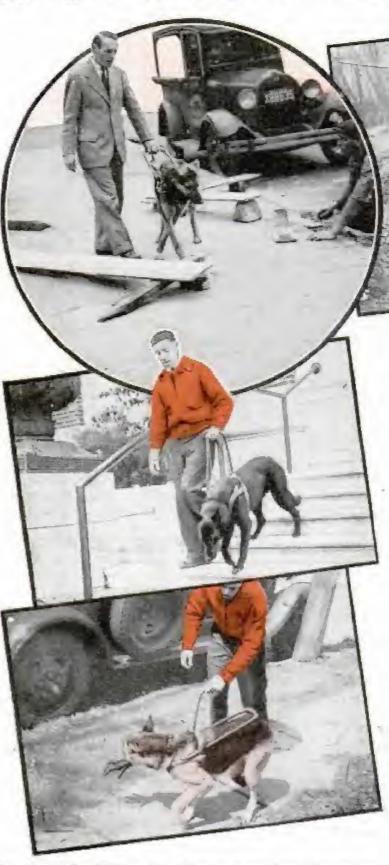
locity. An automatic slide-rule mechanism indicates, just above the control handle, the spindle revolutions per minute and cutfing speeds in feet per minute.

Take States

Chipania machine

morristour, nf

BORROWED **EYES**



Top, Guide Dog Pulling Blind Master Away from Obstruction on Ground, and Teaching Dog to Watch for Overhead Obstruction Which Might Injure or Startle the Master; Center, in Negotiating Stairs, Dog Stops at Landing to Let Master Know It Is Bottom or Top; Below, Dog Is Taught to Bring Dropped Articles to Left Side so Master Knows Where to Reach

ment faller in 3 or

N an eastern city a man earns a living by house-to-house selling and servicing candy machines. This man is blind. Yet he walks eight or ten miles through city streets each day, crosses busy intersections, dodges automobiles and street cars, visits 300 or more strange homes, climbs innumerable stairs and encounters all the usual hazards of city travel.

No one could make such trips without the aid of sight. This blind man "sees" through the two alert and intelligent eyes of a German shepherd dog, one of the many "graduates" of "The Seeing Eye," a philanthropic institution at Morristown, N. J., where dogs are educated to act as guides for the blind.

This man has a mental picture of the streets he travels. He indicates to his four-footed companion the direction he wishes to go. She assumes all the responsibility of taking him safely to his destination and bringing him safely home. The man does not tap cautiously with a cane as he walks. His guide sets a rapid pace and the master walks confidently beside her, certain that she will warn him of any obstacle in his way.

for the BLIND



The dog carefully selects a path which will not allow her master to brush against other pedestrians. She warns him of a step up or down, she watches the traffic when crossing a street, she leads him around obstructions and is even careful to guide him around a hanging awning which might startle him by striking his head.

This dog's keen eyes and intelligent brain have made her master independent. She and other graduates of the Morristown dog college are bringing freedom to many blind people whose activities otherwise would be restricted to the confines of four walls or, at most, to their homes.

The education of a guide dog actually involves three separate courses of instruction—one for the dog's teacher, one for the dog's blind master. The first step in training a guide dog is to train the trainer. It takes four years to make an instructor after the man himself has been carefully selected for the work. Not all persons have the necessary tact, patience and instructor is not an animal trainer, but a teacher, and the dogs are



Top, the Intelligent Head of a Typical Guide Dog and Dog Stopping at Curb Until Master Finds It with His Foot; Center, Harness by Means of Which the Dog and Master Communicate Information to Each Other; Below, the Guide Dog Leads Her Master through Heavy Traffic by Observing the General Direction of Movement of the Vehicles

POPULAR MECHANICS



ent from the man's. Thus he is better able to make the dog realize that a reward or a correction is a direct result of an act rather than an arbitrary action on the part of the teacher.

The animals selected for this work are nearly all German shepherds-which, incidentally, do not have "wolf blood" and which are not "police" dogs, as many believe. Females are used almost exclusively because they are less easily distracted. The guide dogs are carefully selected to obtain certain characteristics. They must be highly intelligent, they must have a sense of responsibility and



Top, Teaching Dog to Sit or Stand at Left of Master; Center, Future Guide Dogs at Play; Below, Indicating Bus Entrance

not trained, but educated to think for themselves.

The main difference between an amateur and a professional in teaching dogs is that the professional, through experience, is better able to "think like a dog." He understands animal psychology and dog intelligence and comes to know the dog's point of view-which often is quite differthey must be gun-sure, because of back-firing in auto traffic.

Since they must not be distracted by inviting scents along the street, they are chosen for a lack of, rather than the possession of a sensitive nose. But they must have excellent eyesight and good hearing. One of these dogs can hear many times as well as a man and their eye sensitiveness to movement is amazing. Frequently a guide dog checks her master at the curb long before he can hear

an approaching car. The dog not only hears the car, but detects the motion and

gauges the speed.

Guide dogs start to school at fourteen months and their education requires three months. This is divided into three steps. First, each dog is taught obedience. She learns to fetch, to sit up, to lie down and to retrieve dropped articles by bringing

them to a certain position where the blind master will always know where to reach for them. She must learn not to chase other animals or chickens, so she is given an opportunity to try it. As she starts after a chicken, her name is called by the instructor and a light chain is flicked into the hind legs. The dog associates the chain with the chicken. She returns to her instructor and receives a caress instead of a reprimand. Then she wags her tail—and starts after another chicken. The chain lesson is repeated. Soon she learns a chicken means only discomfort.

During the second period the dog acquires the rudiments of guiding. She is taught to stop at curbs until her instructor, feigning blindness, finds the edge with his foot or a cane. She learns the meaning of "forward," "right" and "left," the three commands her future master will use to direct her; she learns to lead her teacher around obstructions and to watch that his head does not strike anything. Then she goes into traffic and is taught to dodge pedestrians with her charge.

Because it is not definitely known whether dogs recognize colors and because motorists do not always obey them, the

(Continued to page 120A)

STEEL ROOF DECK IS FIRE-SAFE AND EASY TO INSTALL

Adaptable to all types of commercial buildings and modern residences, steel roof decking is available for constructing smooth roof surfaces. Fabricated from copper alloy or galvanized steel, the decking is lightweight and easy to install, in addition to being fire-safe. An unusual offset facilitates nesting of ribs. After insulation has been applied, composition roofing may be laid to complete the job.



Showing How Roofing Is Applied After Steel Decking Has Been Placed on Building

30W AND ARROW FOR FISHING INTRODUCES NEW SPORT

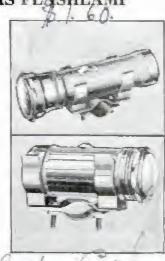


Shooting Fish in Clear Water; Bow Has Reel and Line to Which Arrow Is Attached

Use of the bow and arrow for shooting fish has been introduced in California, the latest in sport. A reel attached to the bow carries 150 yards of line. As the sportsman sights a fish in clear water, he quickly releases the arrow. If a strike is scored, the fisherman may manipulate the reel and bow to "play" the fish until it tires and can be brought to net.

BICYCLE LIGHT WITH CLAMP ALSO USED AS FLASHLAMP

Serving the double purpose of bicycle light and flashlamp, a new two-cell spotlight with clamp is on the market. It may be removed for use as an ordinary flashlight. With this lamp is sold a red tail-light with clamp.



Evanetin delle DS





BILLIARDS is not a hard game to learn but if you aspire to become a really good player, you must first understand the three importan't fundamentals: the "bridge" hand on the table, how to grip the cue at the butt end, and stance, or position at the table. These three points are the princi-

pal elements governing the stroke. But you can learn these fundamentals at any age. A child may run up a high score, and a man taking up the game late in life may develop into an expert.

Let us take first the position of the hand on the table, or bridge. A bridge for ordinary shots can be built by forming a circle



Left, Hoppe Holds Butt Lightly between Two Fingers and Thumb; Right, in Using Substitute "Bridge," Grip at Butt Is Inverted; Eyes Are in Direct Line for Shot

with the thumb and first finger of your left hand, placing the tip of each together. Your middle finger should then be moved downward as far as possible toward the palm. Now slide the tip of your cue through this circle. It should pass over the top of the middle finger, touching it at, or a little above, the middle joint. Tighten

and HOW to PLAY it







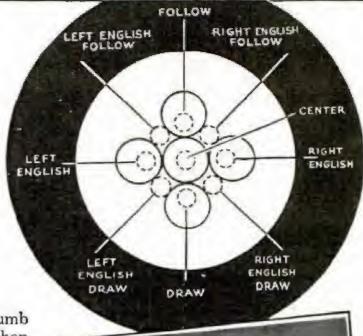
Top, Taking Stance at Table; Diagram Indicates Where to Hit Ball for Draw, Follow and English Shots; Bottom Picture Shows Proper "Bridge" Position of Hand on Table; Above It, Bridge Is Lowered for Draw Shot

the circle around the cue until both fingers and thumb are touching the cue on all sides with just enough snugness to permit the cue to slide through without wabbling. Place your hand on the table with its outside "heel" resting firmly and the fingers well spread.

Of course, you may make adjustments for comfort. If your hand is chubby, and you have difficulty in placing your first finger in the posi-

tion described, try placing your thumb against the side of your second finger, then pull your first finger down, making the tip of it meet the end of your thumb. For complex shots, this bridge can be lowered by pushing the fingers forward on the table or raised by pulling the finger ends toward the wrist.

In billiards, as in golf and baseball, there are many forms of stance, and the player should adopt one suited to his height and build. There is a tendency among many players to stroke with the cue butt too close to the body. This throws the eyes in the wrong position for lining up the shot accurately. The hand gripping the butt should be at least six inches from the body. Better twelve, but don't hold it so far away that it cramps your style.









forward. A cue should not be held by more than two fingers and the thumb. In reality, it simply rests on the first two fingers and is held secure by the thumb.

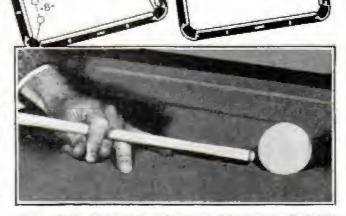
There's no shoulder action in the billiard shot. It's all done from the elbow down-not unlike a clock pendulum in action -with the proper follow through and free and easy wrist action. The cue should not be stopped or jerked back until after full contact with the cue ball. It should follow right through the ball. The more proficient you become in these fundamentals, the greater your success will be in mastering the subtleties of the game.

Top-notch players nev-

Here is one way of attaining a natural, correct stance. Face your shot squarely, holding the butt of the cue about twelve inches from the end with your hand touching your right hip. Turn to the right toward the cue on the ball of your right foot without lifting the foot or moving the right hand, holding the cue, from their original positions. The left foot may be moved forward any distance

required to give balance when you bend. In bending over, place your cue in your bridge hand and lean forward until your eyes are directly over the cue which is in line with your shot. Above all, don't stand rigid. Relax! Tight muscles have no place in billiards.

Before telling you how a billiard cue should be gripped, let me repeat the timehonored "don'ts": Don't hold the cue tightly in your hand; don't hold the cue too far back; don't hold the cue too far



Top, Ruth McGinnis, Wamen's Champion, Exhibits Stance; Diagrams Show How to Hit Angle and Combination Shots; Bottom, One Way to Lower "Bridge"



er miscue. They know where and how to hit the ball. With a little concentration, you can learn the same thing. The diagram on page 365 explains where to strike the cue ball. It represents a regulation ball for a straight rail, balk-

line, and three cushion. Pocket-billiard balls are a trifle smaller. The five larger circles on this ball represent the width of the usual cue tip. The four large circles around the center one indicate the extreme distance you should ever cue the ball away from the center. The small dotted line circles inside the larger ones show the approximate space covered on the ball by the cue tip when it strikes. The small dotted line circles between the four outside large circles indicate where you hit when executing the extreme follow or draw shot with the addition of left or right hand English. It is dangerous to cue your ball farther away from the center than the outside circles. In fact, there is seldom a shot that requires such extreme off-center

cueing. You will be surprised at the follow, draw and English action attained by striking the ball just a little off center. Remember, too, that the speed of your shot has much to do with the action of your cue ball, after contact with the object ball. Many shots are missed because they are played too hard or too easy.

In playing the follow shot, you don't have to cue your ball as far to the top as possible, as is popularly supposed. Never cue more than the width of the tip above center, and remember to have your bridge at such a height that you deliver your stroke with the cue as near on a level as possible.

In pocket billiards, the first thing to know is where to strike the

object ball. In the three shots shown in the figure at the right on page 366 it is clear you should cue your ball center. The heavy black lines show the angle from the pocket to the ball. The point of contact by the cue ball on the object ball is indicated by the dotted lines. In pocketing balls, avoid using English. Cueing the ball on the right or left

Top, Charles C. Peterson, Fancy Billiard-Shot Champian, Demonstrating Trick Shot; Bottom, Wrong Aim for Draw Shot, Cue Angle Preventing Any Follow Through; Diagram Shows How English on Cue Ball Can Throw Object Ball Out of Line

side has a tendency to throw the object ball out of line with the pocket. The illustration on this page shows the course of the object ball as the result of three ways of striking the cue ball. The ball following

(Continued to page 126A)



View of Two Sides of Japanese Newspaper Plant, with Odd Designs That Would Camouflage the Building in War

ODD DESIGNS ON GLASS WALLS CAMOUFLAGE BUILDING

Strange figures decorating the glass walls of one of Japan's latest buildings are not intended for ornament in peace time but for camouflage in war. The designs, including the figure of a prancing horse and a bathing-beach scene, were painted on the walls to conceal from the eyes of enemy pilots the big plant housing the Osaka Asahi, Japan's largest newspaper. Viewed from the ground, the building has a fantastic appearance.

IT TAKES NERVE TO REPAIR LEAKING GAS MAINS

An excited voice on the telephone reports: "The main is broken!" Immediately the gas company calls out its "trouble shooters," linemen who always are on call to stop dangerous leaks. The men clamber into their truck, loaded with the necessary tools and equipment, ready for the dangerous job. Out on the highway, they locate the leak. The air is heavy with fumes. This time an old pipe, laid years before, has given away almost directly under the curbing, and at a point where small brick provided drainage beneath the concrete highway. There is no chance to reach the leaky pipe except through the solid concrete of the broad highway or by prying loose the brick base. The foreman calls for picks and crowbars to tear the brick out so the men can get beneath the pipe and repair it, without disturbing traffic on the heavily traveled highway. The gas cannot be cut off because thousands of homes are dependent on an uninterrupted supply. So gas masks are donned quickly and the men work fast. Danger is at their side constantly. So heavy is the gas that a spark from an iron crowbar in prying a brick out of the ground may mean a terrific explosion. Every person in the danger zone is warned to extinguish cigars or cigarets, and automobile drivers are asked to coast through so no sparks from motor or exhaust will set off the gas.

Making every move count in the battle against time, the crew finally completes the repairs, each man weary but unmindful of the part he played in this drama of peace time. It's all in the day's work.

ELECTRIC HEATER IN SCALES KEEPS OUT MOISTURE

For scales used in close proximity to water, salt solutions, acid fumes or temperature extremes, an electric heating unit is offered. When placed inside the scale

and connected to any convenient wall outlet, the unit creates a blanket of warm, dry air around the vital parts. This prevents moisture from filtering in where it might cause destructive corrosion.



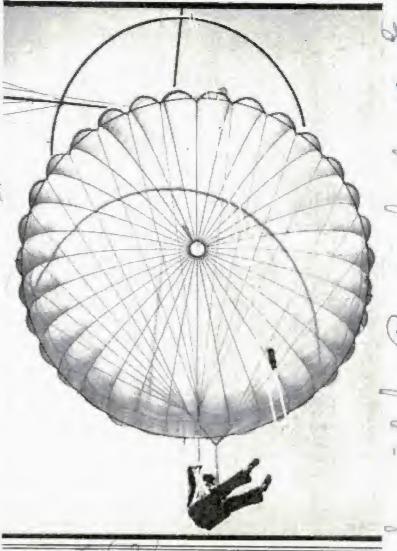
Practice Tower Makes Parachute Jump Safe

Learning to make a parachute jump with the risk eliminated is now possible, using a "captive" open parachute swung from a 125-foot training tower. The jumper is hoisted by cable to a point ninety-five feet above the ground where the open "umbrella" is automatically released and



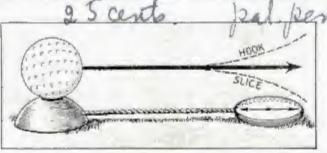
Left, Student Makes Practice Jump after Being Hauled Up by Cable; Right, Closeup of Parachute

he floats down. The parachute can also be released at any other height by pulling the rip cord. Confidence is instilled in the student jumper by making the leap under control yet simulating actual flying conditions. A ring at the outer rim of the silk umbrella keeps it open at all times. The first such tower was built about twenty miles east of Trenton, N. J.



GOLFER IS GUIDED IN DRIVING BY ARROW FIXED TO TEE

To help the golfer drive straight a domeshaped tee with a weighted arrow attached by a cord is offered. It enables the player to line up his shot for the flag. The ball is always at uniform height. By lining up the arrow for the green, then driving the club head through the ball and over the cord and arrow, the golfer learns to keep his head down and eliminate slice and hook.



Arrow Helps Follow Through for Straight Shot; Ball Is Always Teed Same Height

Classy Ose

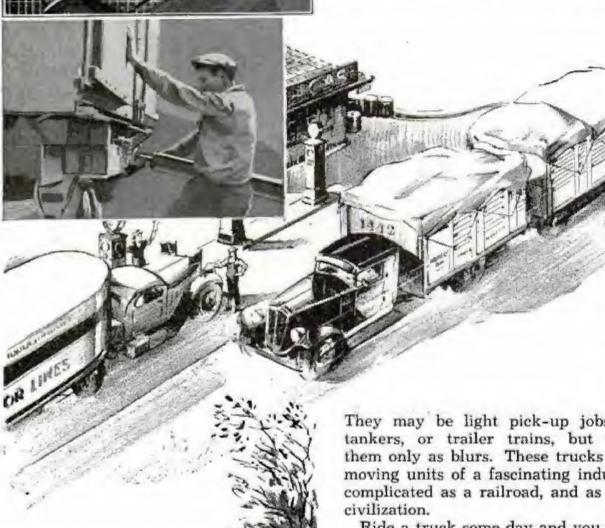
457 D. Derraño an

RAINS

THE foreshortened truck-tractor backs up to a waiting van. Couplings clash as they meet. A moment later it backs up to an open-body trailer. Again couplings clash. The train is made up.

It is a train in every sense of the wordexcept that it has no tracks. It has a power unit as separate from the cars as a locomotive is separate from its coaches. The cars are coupled and uncoupled, spotted for loading, switched, and handled like railway cars. But the track is the public highway.

To most of us, a truck is just a lumbering, clumsy vehicle that slows down traffic.



Top, Truck Dispatcher Transmitting Orders by Telephone and Maving Pegs on Board to Indicate Position of Trailer Units; Center, Swamper Coupling Trailer after the Driver Has Maneuvered to Place the Hook under a Four-Inch Ring

They may be light pick-up jobs, great tankers, or trailer trains, but we see them only as blurs. These trucks are the moving units of a fascinating industry as complicated as a railroad, and as vital to

Ride a truck some day and you will get the picture. While you're at it, ride the very latest thing in heavy transportation, the truck-tractor and trailer train.

A long line of empty trailers and semitrailers are in front of a terminal loading









Top, Washing Power Unit of Truck-Tractor; Center, Waiting for Loads; Below, Coupling Air Line

The dispatcher is busy because the equipment has gotten out of balance. There are too many empty trailers at one terminal, and not enough at another. Just as railroad divisions have car shortages, so the terminals of a line-haul trucking company are faced with trailer shortages. The dispatcher yells into two phones, and moves pegs in the equipment board before him. Then he turns to the teletype machine and sends a message to the harbor, reporting the leaving of the oil drums.

Meanwhile the driver checks his air brakes which are energized by a huge suction cylinder connected to the motor. The tractor couples to a semi-trailer. The retractable front wheels are wound up and the weight of the cargo is borne by the rear wheels of the tractor. The semi-trailer swings on a swivel, or "fifth wheel." This makes the equipment flexible. and able to negotiate sharp turns. Air lines are connected. The safety

chain is hooked, "O.K.," the swamper calls.

The tractor and semi-trailer roll out. In the yard the driver jockies for position. It is a tricky business. In backing, the semi swings the opposite way from the tractor. It is like trying to back an automobile with a hinge in the middle.

A loaded trailer is the object of the switching. Back comes the semi. A swamper stands ready,

holding the trailer tongue. The four-inch ring on the end of the tongue must drop over the hook on the rear of the semi. There are four inches leeway. Back comes the tractor, The hook slips under the ring. The driver has hit! They don't often miss. They are steering fifteen tons of equipment, thirty feet long, but they can slip a hook under a four-inch ring. The swamper locks the coupling, the tractor slips into the first of its twelve speeds and rumbles out of the yard, the semi and trailer swaying behind it.

Ahead lies the traffic of the city. Beyond is the open road, and beyond that the harbor where a freighter waits for the oil drums. The powerful motor roars. Gears clash as the driver slips into second, then into over-drive between second and high. A traffic light shows red. The driver checks with the air, checks again, then uses the foot brake to come to a stop.

Slowly the train again gathers speed. It takes a long time to get it rolling. The

(Continued to page 122A)

Locomotive Styles Are Set by Age of Speed



Left to Right, High-Funneled Burlington Locomotive of 1882; "Hiawatha;" Milwaukee Road's Steam Engine; North Western's "400"; Burlington's Diesel "Zephyr"; "Abraham Lincoln" of Alton Line

Fifty-three years old and still running, a Burlington railroad wood-burning locomotive posed for its picture with four spry young engines that pull the new high-speed trains of the west. The old-timer with its tall smokestack hauled the "Burlington Limited" in 1882. Lined up in the

Chicago yards were the speed-lined oilburning steam locomotive of the Milwaukee railroad's "Hiawatha"; the conventional oil-burner of the North Western's "400"; the Diesel electric "Zephyr" of the Burlington, and the Alton road's steamdriven engine of the "Abraham Lincoln."

Golf and Croquet Are Combined on Homemade Course

Played on a homemade course twenty feet long by ten feet wide, a combination of golf and croquet has been introduced in Ohio, Golf balls and putters are used on the course which is laid out like a croquet court. Iron stakes replace the croquet wickets on the packed clay course. One feature is the variety of carom shots that can be made off the wooden retaining rails around the course.



Croquet Court Has Walls for Caroni Shots with Golf Balls and Putter

ots with Golf Balls and Putter

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POPULAR MECHANICS

Paddle-Wheel Auto Travels on Land or Sea

The English channel, scene of many unusual passages, including ones by mermaids, mermen, water bicyclists and a

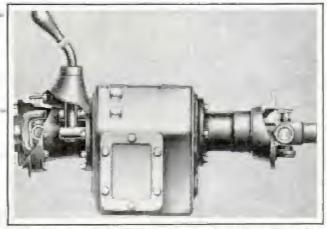
German who tried to walk aeross on water skis, was negotiated recently by another German in an amphibian automobile. The

car was equipped with paddles on the rear wheels and crossed from Calais to Dover in eight hours and twenty minutes, clambered onto dry land and proceeded on to London. The driver had motored by land from his home in Germany to start the crossing. The vehicle has a land speed of about twenty miles an hour and a water speed of five miles per hour. At sea the water level is even with the running board.



Top, Amphibian Automobile Landing on English Shore; Right, Cruising across British Channel; It Can Tracel Twenty Miles on Hour on Road and Paddle Five Miles un Hour on Sea

Special Transmission Unit Triples Truck Gear Range



Easily Installed Transmission Unit Gives Trucks Twelve Forward and Three Reverse Speeds

Designed to replace the present transmission in late model Ford or Chevrolet, trucks, a new unit gives twelve speeds. forward and three reverse. From the wide range of ratios, there is one to serve almost any demand of the driver for maximum power or speed. There are four compound gears with a high-high for either fast, travel at usual engine speed or for regular 🔖 road time with the engine running twenty per cent slower, with less wear and less gasoline and oil consumption. It combines in one unit the standard ratios, the "un derdrive" and the "overdrive."

MINIATURE LOCOMOTIVE ABLE TO HAUL PASSENGERS

Exact copy of the real thing, a homemade locomotive built at Norway, Me., hauls passengers on an "elevated railway" laid on four-by-six timbers atop cedar posts. It weighs 150 pounds, carries six pounds of coal and can null nearly a ton of cargo. Hs boiler holds two gallons of water and the tender stores another two and one-half gallons. There are four driving wheels and a thimblesized steam gauge which registers 120 pounds of steam pressure.

DEEP GAP IN LATHE BED FOR TURNING BIG WORK

Objects of larger diameter than can be turned

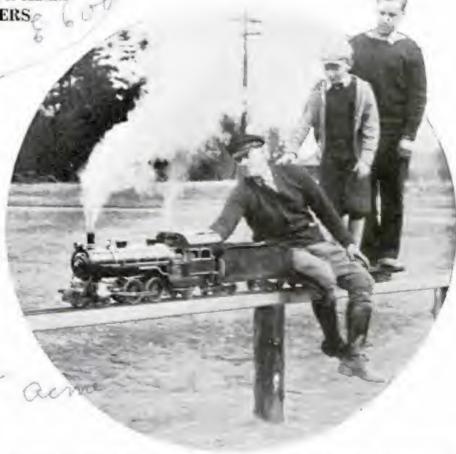
on the ordinary bench type lathe are handled easily by a new bench lathe with a deep gap in its bed. The swing at the gap is thirteen and one-half inches. Developed primarily for the popular hobby of metal



Thirteen and One-Half Inch Swing Is Provided in This Lathe Built for Metal Spinning Hobby

spinning, the extra capacity is useful for large faceplate work on ordinary wood or metal turning.

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



Despite Its Size This Steam Engine Running on Fence-Top Railway Can
Pull Nearly a Ton

FIRE-ENGINE DATA COMPUTED BY HANDY RECKONER

Answers to practically all hydraulic questions in the fire department can be found quickly by using a handy computator. The machine determines the required engine pressure for all nozzles from seven-eighths inch to two inches, with nozzle pressures of twenty to 100 pounds on hose lines 100 to 1,000 feet long. It will give the gallons per minute, vertical reach and horizontal reach of streams and 1,900 an-

swers to other hydraulic questions. The machine contains two spools on which is a paper ribbon with numbers. By turning a knob, the ribbon passes a small window and



a small electric lamp illuminates the number giving the answer to some particular question. The machine is made of steel, chromium-plated, and mounts on the side of the fire truck.

lan. Lak

PIGEON



INCLE SAM'S newest combat unit, the midnight patrol, is ready for service. Tom, Jim and Jerry are prepared for any emergency where night messages are concerned. Tom, Jim and Jerry are the army's ace night-flying pigeons.

Training pigeons for night flying in time of war is a new development of the army

signal corps. Day flying has long been established, but only recently has night flying been started and only a few birds capable of this extraordinary feat are in ex-

In developing the night flyers many obstacles had to be overcome. For pigeons, like most birds, settle down at dusk. Night flying was a trick that had to be superimposed on natural instincts. So the signal corps selected its best birds, both as to intelligence and physical endurance, for this work.

"The first thing needed to train night flyers," says Pri-

vate Henry Hegge, ace trainer for the corps, "is a satisfactory loft condition. The training must be at night and night conditions must prevail, either artificially or naturally, for the exercise of the pigeons."

At Fort Monmouth, N. J., where training takes place, it is necessary to create night-flying conditions. This is accom-

MIDNIGHT PATROL



Method of Wing Marking Formerly Used, and Carrier Pigeon Which Was Wounded in Action

plished by darkening the loft during the day and lighting it only at feeding time in the morning and at night during the training period. The first step is to get the birds to come into the loft from near-by spots. This is accomplished by letting them out at dusk for a few minutes and letting them in when they return. The light on the landing board is turned on when their wings are heard fluttering around the loft. Perhaps at first they make no attempt to come in. In this case they

This training period, which usually lasts six or seven months, is followed by taking the birds out a little later at night. Here again it may be necessary to stir them up before they learn to come in on the "light" or of their own accord. This period is followed by a third which consists of diswhich with Messare wis tain just train casus are extended the part of the part

tance and "road flying."

Road training consists first of taking the birds out about three miles and liberating them one by one in the twilight. This provides the incentive for the birds to return to the loft. Otherwise they might bunch and settle down somewhere outside. After the birds learn to come in from the threemile distance by twilight, darkness is substituted. As the birds learn, they are released still further away. By the time the extension of their homing has been increased to twenty miles it is possible to release the birds as a

unit. To date, these night flyers have been taught to come in from a distance of fiftyone miles on land. On the sea the distance has been increased to sixty miles—a world record for night flying. It is not impossible, says Private Hegge, to teach these birds to fly 100 miles at night with messages.

The best birds for the night patrol are the descendants of the best army flyers. It seems these birds hand down to their offspring their flying ability, developed by their human trainers. Birds are taken for training at the age of three or four months. Precautions are taken to see that the loft where they are kept is not surrounded by wires, buildings, trees or other objects which might interfere with their homing. Messenger pigeons are valuable and care is taken to prevent injury during the training period. War casualties, however, are expected.

The homing pigeon used by the army is the product of sev-



Method of Transporting Members of Midnight Patrol, and Group of Army Pigeons Returning Home in Early Morning after Long Night Flight

eral years of crossbreeding. They are all the descendants of the rock pigeon or bizet of Europe. These birds are noted for their superior intelligence and physique and for their homing characteristics. If kept in perfect condition, they can fly great distances in all kinds of weather. Great care is taken not to overburden them with flight tasks. Normally most birds of good breeding can fly 300 miles, but over this distance extreme care must be taken in selecting the birds. Only one bird in ten is capable of a 500-mile flight and such flights should never be imposed on the bird without giving it a month's rest.

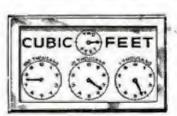
(Continued to page 122A)

Union air Sernina MECHANICS

HOW TO READ YOUR GAS METER AND CHECK YOUR BILLS

United au Lines

It is easy to read the gas meter in your home and check on your gas bill. The ordinary gas meter has four dials whose hands begin moving slowly as soon as you turn on the gas. The needle of the dial marked "Two Feet" revolves perceptibly

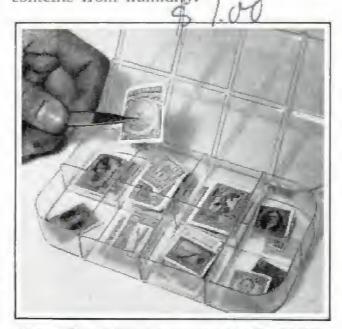


and is used only
for test purposes.
The other three
dials, which move
more slowly and
register gas consumption, show

the number of cubic feet used in ten thousands, thousands and hundreds. If the hand is between two figures, always take the lower number. Thus, in the dials illustrated, the hand at the left registers 70,000; the middle one 6,000; the right, 400, or a total of 76,400 cubic feet. Subtract your previous reading from this to determine the amount of gas used in the period.

TRANSPARENT BOX HAS BINS FOR SORTING STAMPS

Designed primarily for stamp collectors, a transparent box with eight compartments may be found equally convenient as a catchall for small objects in the machine shop or the sewing room. It is made of strong but light, rigid celluloid with a tight-fitting hinged top that protects the contents from humidity.



Hinged Top of This Transparent Box Fits Tightly and Keeps Out Humidity



"Eyes" of This "Hot Dog" Stand Gleam with Electric Lights; Side Opens to Shelter Patrons

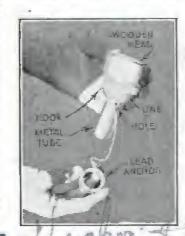
GIANT DOG MADE OF CONCRETE HOUSES ROADSIDE STAND

Located beside the Pacific highway in Oregon is a large concrete, lumber and stucco dog that houses a refreshment stand. The "eyes" gleam at night, being electrically lighted. The dog is nearly ten feet high, six feet wide and thirteen feet long. A trap door opening at one side provides a canopy under which patrons may sit while being served. A shelf folds down to form the counter. The structure is piped for water, wired and equipped with cooking and refrigerating apparatus.

MARKS WHERE FISH BITE 683

To mark the pool where the fish are biting or the spot where your angling or hunting equipment fell overboard, there is a handy "vest pocket" size buoy that stays where it is dropped. A lead ring acts as anchor. As the anchor line unreels, water

enters five holes in the tubular base of the buoy and keeps it upright. When the anchor reaches bottom a screw hook prevents further unwinding of the line. Different colored line at intervals tells the depth of the water.



ROPULAR MECHANICS

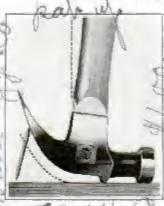


Apparatus for Sending Fingerprints by Wire; Note Equipment for Quick
Comparison of Prints Received by the New System

FINGERPRINTS SENT BY WIRE TO SPEED UP JUSTICE

Fingerprint information can be transmitted by telephone or teletype with a new system designed to speed up crime detection. The system consists of a magnifying glass and a disk of 100 squares, each two millimeters in size. Letters are used to indicate particular squares by which a certain suspect's prints may be compared with a set taken at an earlier date. Fitted to the magnifier, the letters indexing outstanding characteristics run from left to right. The method of assembling information for transmitting by wire is based on the fundamental principles involved in the general classification of fingerprints.

HAMMER FOR EASY PULLING HAS FULCRUM HEAD



Equipped with a head that has a small fulcrum cast directly into the metal, a new hammer pulls nails easily without the danger of breaking the hammer has a long, easy angle

claw with plenty of space between the claw and the handle to get under a two-inch plank. The neck is shaped so the nail will not move away while being driven. The large diameter of the face makes driving more accurate.

GOLF IS IMPROVED BY TRAINING LEFT HAND TO SWING

Expert golfers tell you the left hand and arm must control the swing, so a practice club has been designed which forces the left hand to take charge of the stroke. That portion of the grip held by the right hand is

kept in position by an adjustable spring, and pressure pulls the grip loose whenever the golfer's right hand overpowers the left in raising the club or bringing it down.



Practice Club Has Grip Which Is Pulled Loose When Right Hand Takes Improper Control of Saing

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Fish Are "Fingerprinted" and Bred as Game

Fish are now being "fingerprinted" to study their habits and travels and are scientifically interbred in efforts to keep the lakes and rivers stocked with the sportiest species of game fish. The scales of salmon have distinctive individual markings just as human fingers have. To trace the Atlantic coast salmon to their spawning grounds and learn their ages, fishery scientists caught them in nets, numbered them



Top, Planting Fish Eggs in Gravel Bed of Stream; Left, Fertilizing Salmon Eggs in Pan; Center, Pike Chokes to Death Trying to Swallow Whitefish

with tiny metal tags and released them after recording the day and place and scale prints. Rewards were given for the return of the tags with samples of the scales whenever the fish were caught, the scales double-checking the identity of the fish. Ocean salmon and fresh-water salmon have been interbred at fisheries, and by breeding brown trout and Atlantic salmon the scientists produced a new trout combining the best fighting game qualities of the two species. European brown trout

have been planted in Pacific coast streams and Atlantic salmon are now mingling with Pacific salmon on Vancouver island. Canadian fish hatcheries last year planted 100,000,-000 artificially hatched fish eggs to restock lakes, streams and rivers. Certain lakes whose game fish

had been killed off by predatory fish were treated with copper sulphate, which killed the predatory fish and prepared for restocking the water afterward with sporty varieties. To determine whether artificially hatched fish were as healthy as others, natural born speckled trout, well-fed hatchery trout and hatchery trout that had been starved were placed in test pools to forage for themselves. After two days all three groups were found to be in equally good condition.

8464

DOING IT



CREAT inventions have often come about by slight changes of a trite and time-worn experiment. The old law then appears to have fallen apart and to run exactly opposite to expectations. If you are asked, "Will lead float?" or "Can you pump dry Portland cement?" you probably will answer in the negative. But wait!

Years ago an observing woman was washing the shirts of the miners in a Colorado town, Sur-

rounded on all sides by mining activities she had absorbed a general knowledge of the subject. As she swished the clothes in the soapy water she noted the glistening black mineral, galena, floating on the foam.

"That's strange," she said to herself, "lead minerals are too heavy to float, but they are floating just the same—it must be the oil in my soap."

The oil in the soap was the changed condition that caused the lead minerals to float. She made lead float. Her intelligent observation gave to the world the oil flotation process in which the heavy minerals float to the top of the water, and the lighter ones are made to sink. By far the great-

er bulk of the world's copper, its lead, and its zinc, even the heaviest minerals of all, gold, silver, and platinum, are now processed by this woman's discovery. She reversed the natural order of things.

A man in Chicago was obsessed with the idea of a machine to fill sacks. He wanted a simple machine that would function with

8464

BACKWARDS



a minimum of attention. There were machines on the market but they were too slow, or did not weigh accurately or did not fit into his ideas. And then one day the flash came to him. He tied the sack first and then filled it.

Last year in America alone more than a billion sacks were first tied for shipment—and then filled. He simply cut a hole in one corner of the sack, stuck a tube in the hole and forced the material through the hole into the sack. He cut the hole so

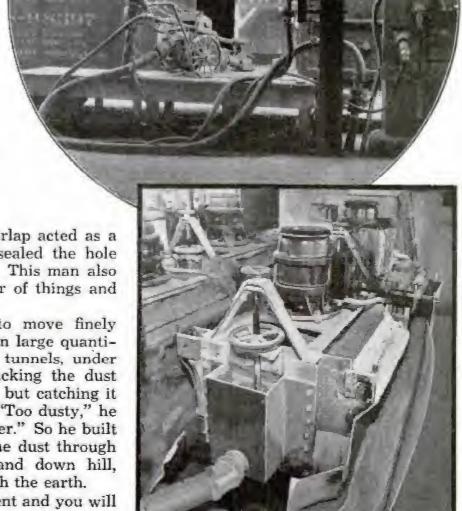
that a fragment of the burlap acted as a little flapper gate which sealed the hole when the sack was filled. This man also reversed the natural order of things and made a fortune.

Another man wanted to move finely ground rock cheaply and in large quantities over bridges, through tunnels, under the water—any place. Sucking the dust into fans was one solution but catching it again was not so simple. "Too dusty," he said, "I'll pump it like water." So he built a pump and he pumped the dust through the long pipes, up hill and down hill, around corners and through the earth.

Try this simple experiment and you will see how it is done:

Place a few pounds of dry Portland cement in a bucket and stir the powder with

(Continued to page 124A)



Pumping Cement into Freight Car, and Flotation Unit Which Causes Heavy Minerals to Come to Top

POPULAR MECHANICS

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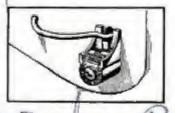
Toy Balloon Blocks Hats for Easy Cleaning at Home



Left, Balloon Is Inflated; Right, Hat Is Placed over Balloon and Cardboard Laid on Brim; Below, Hat Ready for Cleaning and Blocking

Cleaning and blocking your own hat at home is easy with a rubber balloon inflated for the "block," which has just been placed on the market. The stem of the balloon is inserted through a hole in the side of a metal base on which the hat rests. After the balloon is inflated to fill the hat firmly, a cardboard is placed over the felt brim to keep it in place and the hat crown presents a firm surface for cleaning.

LOCK FOR AUTOMOBILE HOOD INSTALLED WITHOUT TOOL



Requiring no tools to install it, a small automobile hood lock to prevent tampering with the engine is

now on the market. It is designed for 1935 Fords and Studebakers and cars using the same type of auto hood catch. A locking bar is inserted through the rear catch slot, the hood catch handle is placed in its locked position, and when the key is turned it becomes impossible to release the hood catch. Turning the key hard to the right acts as a screw and prevents hood rattles.

GLARELESS LAMPS TO LIGHT GIANT BAY BRIDGE

When the San Francisco-Oakland Bay bridge is completed, it will be illuminated by the latest sodium vapor lamps. So free from glare are these lamps that anyone looking directly into the powerful glow from a few feet away will not be blinded. The lights will be posted twenty-six feet above the roadway on 1,000 standards which will

be spaced at 150-foot intervals from one shore to the other, and on both decks of the giant bridge.



Sodium Vapor Unit to Light Double-Deck Bridge

ROPULAR MECHANICS

RUST BILL IS CUT BY COAL CAR MADE OF STAINLESS STEEL

Rust costs American railroads an estimated \$150,000,000 every year. In an effort to stop this waste a stainless steel coal car has been built, eliminating the necessity of repainting. The stainless steel is lighter than ordinary steel, thus increasing the ratio of pay load to total weight. Being harder, it endures the wear of ore loads better and resists the corrosive effects of weather and chemicals. Rain falling on a load of coal frees sulphuric acid, which acts on ordinary steel injuriously, and calcium loads are also harmful.

HOMEMADE THREE-WHEEL CAR IS HARD TO UPSET

Built by a young Minneapolis mechanic during spare time, a three-wheeledstreamline automobile driven by a standard four-cylinder motorcycle engine has defied deliberate attempts to upset it. Taking curves at high speed it tipped to T forty-five degree angle without turning over. The car is forty-six inches high and accommodates two passengers. It will travel eighty-five/miles an hour and run' forty miles to a gallon of gasoline. The engine is at the rear, leaving space for battery, tank, and/luggage under the hood. Conventional controls and front-wheel steering are provided. Frame, body and top are all steel. Front axle and brakes are standard Ford, and Ford wheels were cut down to carry twenty by four airplane tires. The motor is cooled by air scooped through vents in the top.

JU!



Compare Size of Midget Three-Wheeled Car with Small Plane; Motorcycle Engine at Rear of Auto Drives It Eighty-Five Miles an Hour



Forester Pranes Low Branches with Circular Saw Atop Pole, Driven by Engine Hauled on Toboggan.

POWER-DRIVEN SAW ON POLE SPEEDS FOREST PRUNING

Mounted on a hollow aluminum pole to reach up into the trees, a power-driven circular saw manned by one forester can do the work of four men using hand saws. The sixty-pound outfit consists of a small gasoline engine, flexible shaft with hous-

ing, pole and saw. It can be hauled through the woods on a small toboggan or wheel gig by one man. The circular saw makes a smoother cut, and climbing and hand labor are obviated.

([Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped envelope.

CHINESE



Top, the Chinese Sword Trick; Below, Breaking Chapsticks with a Paper Napkin, and Supporting a Glass Bottle by a Rope Stuffed in the Neck; the Small Ball Is the Secret

By HARRY BLACKSTONE

Famous Magician

THE real magicians of the Orient are the Chinese and not the Hindus. Most magicians in India are street-corner fakirs who perform the old tricks of their great-grandfathers, their methods being handed down from one to another. In contrast, Chinese magicians have a true stagecraft,

and many of the best tricks presented by American and European magicians are of Chinese origin,

To illustrate the ingenuity of Chinese magic, let us examine some of their simpler tricks, most of which require such common objects that you can perform them yourself.

The broken chopstick trick is an excellent close-range mystery. A spectator

AGIC OPENING IN DUMMY'S CHEST FOR HEADPLATE FITTED AROUND ACTORS HEAD holds two light chopsticks between his hands, keeping them in a horizontal position. As the magician, you take several strips of paper and slap them downward against the sticks. You deliver a final

stroke and the strips of paper break the chopstick squarely in half,

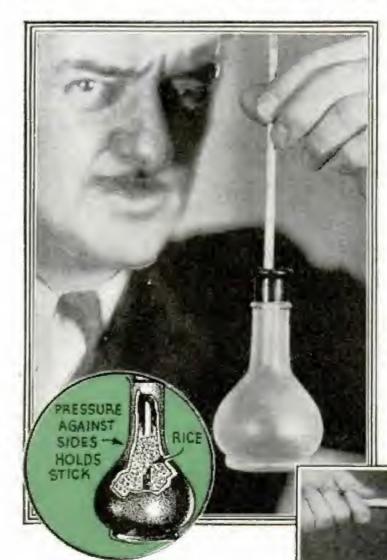
There is a trick to the final stroke, As you bring the papers downward, extend your forefinger. Completely hidden by the papers, the forefinger strikes the sticks and breaks them. A variation of this trick consists of breaking a lead pencil with the creased edge of a dollar bill. This is inferior to the original Chinese version, for the strips of paper cover the finger better.

Here's another chopstick trick. One chopstick is balanced on end on the table, while you attach the other stick to the string of a tiny bow. From a distance of several feet, you shoot the chopstick arrow

The Decapitation Trick Used in a Movie; Note Body of Man Concealed in Headless Dummy

and strike the standing target. Both sticks are weighted in one end. That makes it easy to stand the first one on the table. When the second chopstick is discharged from the bow, its weighted end causes it to turn in flight. Swinging sidewise, it strikes the standing stick and sweeps it from the table.

A single chopstick and a rounded bottle of rice are the "props" for another Chinese perplexity. Fill the bottle with rice,



that, he draws the rope from the bottle and gives both for inspection.

The bottle used is an opaque one, more of a vase than a bottle. Inside it is a small ball of cork or rubber about half the diameter of the neck of the bottle. The magician inserts the rope. When he winds it about the neck, he tilts the bottle and the ball rolls into the neck. It cannot roll out because of the rope; and when the magician tugs the rope slightly, the ball wedges between it and the bottle neck. At the finish, the magician holds the bottle by the neck and draws the rope clear. The tiny ball, pulled along, falls unnoticed into his hand.

Another unusual trick is performed with an assistant, who holds a large wand between both hands. The magician winds a stout cord about the wand and ties the ends around the neck of a vase, which is suspended beneath the wand. At the magician's

thrust the chopstick down into the rice, deliver an incantation and lift the chopstick. Up comes the bottle of rice, "magnetized" to the stick. This trick works itself. When thrust into the rice, the chopstick forces the grains to the side of the bottle and the pressure is sufficient to lift the full weight with the chopstick alone. To remove the stick, grip the bottle with one hand and twist the stick with the other.

Chinese magicians also do this trick in a different form. This ver-

sion requires an empty bottle and a piece of rope. After lowering a loose end of the rope into the bottle, the magician wraps the rope around the neck, then turns the bottle over. The outer end of the rope falls free, but the rope does not drop from the bottle. Instead, it hangs suspended, one end still in the bottle. Then the magician grips the free end of the rope and lets the bottle hang dangling from it. After

Above, Chopstick Supporting Bottle of Rice and the Secret; Below, Note Opposite Wrapping of Rope and Concealed Tack in Wand Trick

command, the vase drops, carrying the ropes with it. The magician catches it before it reaches the floor. He shows the wand to be quite solid, despite the fact that the ropes apparently cut through its center.

STICK

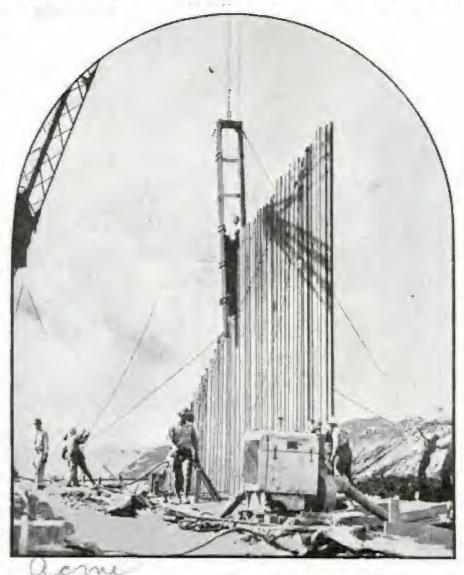
This trick depends upon a short pin, or a tiny tack, previously pressed into the center of the wand. The assistant holds

(Continued to page 116A)

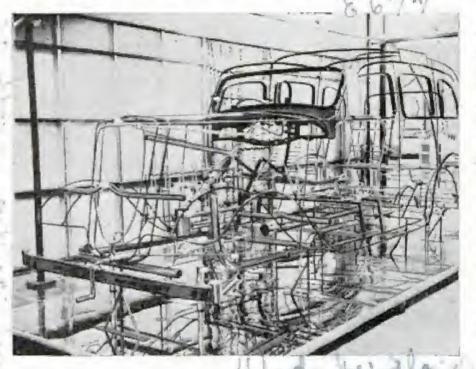
Steel Piling for Dam Is Driven in Solid Rock

Drilling a steel "picket fence" fifty feet high and nearly a mile in length down into a solid rock bed was one of the tough assignments of the construction crew in the Tennessee Valley project. A mile-long earth dam on one side of the river at Pickwick Landing, Tenn., had to be protected from the danger of being undermined by water above the triple dam, which, when completed, will consist of a concrete span across the river and connecting dams of earth on either bank. For the reinforcing wall, the builders used sheet steel, which they pounded deep through the earth until it was firmly imbedded in the rock bottom. A huge pile driver did the job.

Driving Steel Pilings into Ground to Form Solid Wall That Will Protect Earthen Dam in the Tennessee Valley



"Skeleton" of Modern Auto Shows Use of Metal Tubing



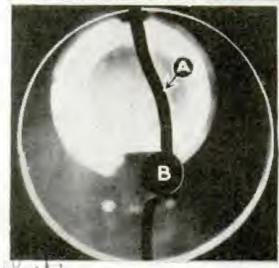
To demonstrate the amount of metal tubing required in the building of a modern automobile, an "invisible car"—merely the "skeleton" in tubing—was placed on exhibition recently at the British Industries Fair in London. Its weird outlines showed exactly how much metal tubing goes into the 1935 car and what purposes it serves in body and motor.

Outlines of Fenders, Doors and Windows, Running Board, Hood and Radiator Grille Are Easily Identified in Skeleton Car Demonstrating All Parts Made of Metal Tubing 390 P

POPULAR MEGHANICS

BULLET "STOPPED" BY LIGHT WHEN IT STRIKES WIRE





Top, Gan Firing Bullet; Bottom, Bullet "B" Caught by Camera Lens as It Severs Wire "A"

Fired from a small gun at 250 miles an hour, a ball was made to appear motionless in air when it was momentarily illuminated by a glow tube. When the bullet severed a wire in its path, current was discharged in the tube and the light had the effect of "stopping" the ball. The photograph was taken at the instant the wire was broken.

SOFT WOOD IS MADE HARD BY RESIN TREATMENT

Wood can be hardened, resisting abrasion and moisture, by a newly developed treatment with synthetic resin. Golf club heads are being thus treated to give them maximum hardness. Baseball bats gain high resistance to

chipping and splitting; wooden airplane parts are made stronger and more weather-proof. One of the objectionable characteristics of wood is its change of volume with moisture content. Warping and checking are caused by uneven moisture distribution. This is prevented by the resin treatment. The wood is first maintained in a vacuum and then submerged in a synthetic liquid resin of the phenol and formaldehyde condensation type. Pressure of several atmospheres is introduced, and afterward the wood is cured for 100 hours at 200 degrees Fahrenheit. The manufacturers say the process assures absolute uniformity of resin distribution throughout the wood. The surface is hardened, taking lacquer and varnish readily and obviating any primer coat. If a high gloss is desired, a second resin application gives a durable finish bringing out the natural grain. Wood doubly coated can be submerged in water six weeks before reaching normal moisture content, eight per cent.

MAN'S SHADOW TELLS THE TIME ON SUNDIAL IN PAVEMENT

Painted on a street in Walla Walla, Wash, is a large sundial that tells time with a human shadow. When a pedestrian wants to know the time, he steps to the center of the dial and his shadow falls through the hour.



When This Man Stepped on the Street Sundial His Shadow Told Him It Was About 5:15

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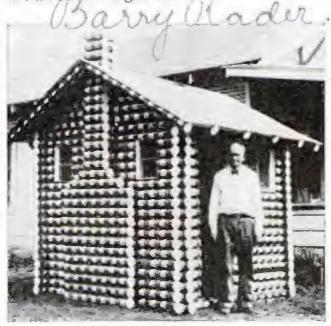
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"BLIND SPOT" IN MAP OF YUKON ERASED BY EXPLORERS

Yukon's "blind spot," a fwo-thousand square mile mountain wilderness never before on the North American map, has been surveyed and charted by an expedition that spent four months in the field. Led by Bradford Washburn, the explorers reported the discovery of several gigantic mountain peaks, located their position with instruments and put them on the map. Carrying cameras and surveying apparatus up to a height of more than 12,000 feet on Mount Hubbard, the expedition established the highest survey station in Alaska or Canada. Two of the newly found mountains were named "King George" and "Queen Mary" in honor of the silver jubilee year of the British king and queen. The men were the first to cross the St. Elias mountain range near the border of Alaska and Yukon on foot, and this was the greatest test of their stamina. The region is extremely rough, with lofty mountain ranges cut by deep gorges and wide, glacier-filled valleys.

PLAYHOUSE BUILT OF OIL CANS MODELED AFTER LOG CABIN

More than two thousand oil cans form the walls, chimney and roof of a "log cabin" type playhouse built by a garage man at Muskogee, Okla. Tin cans were flattened out for the roof, and solder holds the structure together.



Garage Man Soldered Oil Cans Together to Build



Sixteen-Story Apartment House Skyscraper in Paris Suburb Built of Steel Units and Cement

APARTMENT TOWER COSTS CUT WITH STEEL AND CEMENT

Apartment house skyscrapers of steel and cement are being built in a suburb of Paris. Their construction is simple and economical, the framework of the towers being of standardized steel units. Each skyscraper is sixteen stories high and accommodates 150 apartments.

REST TIME OF SEEDS IS VARIED BY TEMPERATURE AND LIGHT

Light rays and temperature affect "sleep" time of seeds. Experiments show cereal seeds rest short periods at high temperature, but lie dormant for weeks near freezing with other conditions good for germination. Red light rays of around 7,600 angstrom units tend to make lettuce seeds sleep, while 7,000 angstrom red rays and 5,200 angstroms yellow stimulate the seeds.

Merace

HALF an ACRE and

By H. W. MAGEE

WOULD you like to own a home?
Why not buy it and let your grocer
and landlord pay for it?

Thousands of urban tenant families have this opportunity. Most such families pay enough for food and rent in a few years to purchase a home. All the rent money and much of the food money can be diverted to home payments if the family is willing to contribute a few hours of labor per week to the plan.

The secret lies in selecting a building site containing one-half acre of arable land. Your half acre will help to pay for the home you erect on it by producing most of the food your family eats, for this amount of ground will almost support five persons. It is surprising how much food can be grown on a few hundred square feet of good soil.

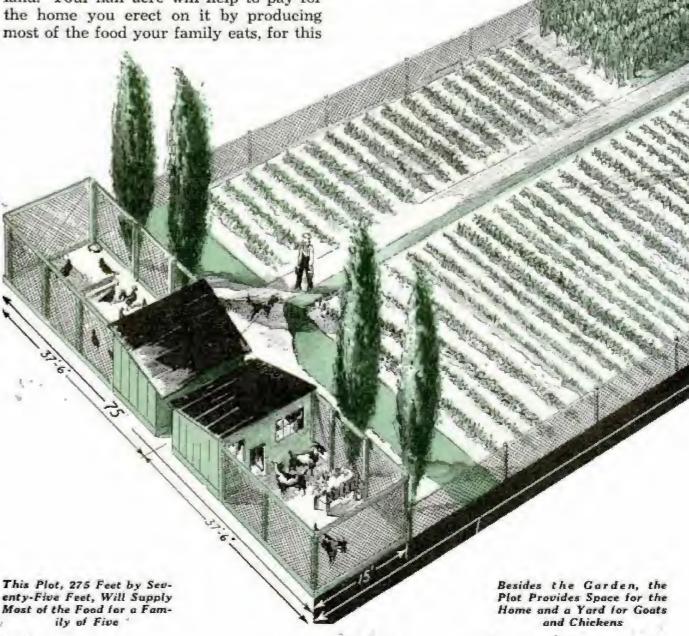
The average urban tenant family in 1933 had an annual income of \$1,062 of which \$252 went for rent, according to a department of commerce survey covering sixty-one cities. These figures probably are not far wrong today. Of the \$810 left after rent was paid, this typical

tenant family probably

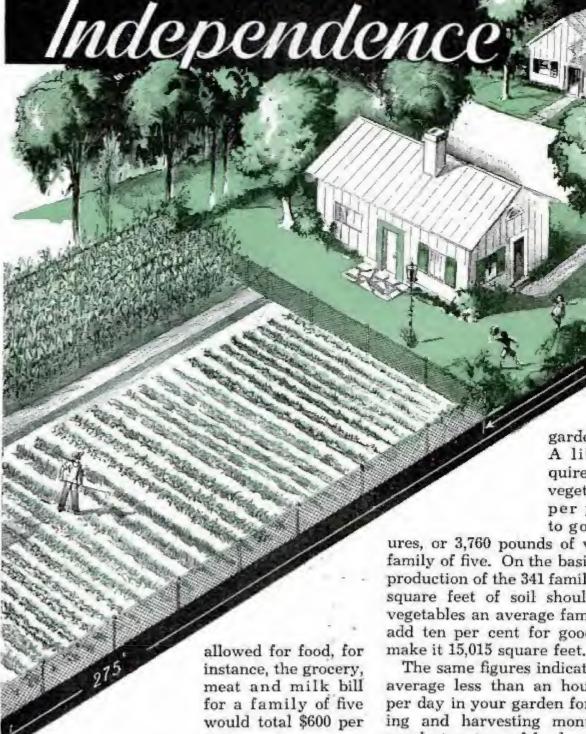
spent more than half

for food. If \$10 per

month per person were



Stalox Co, 59 W. austin and



year. Here's what the same family can do in the way of feeding itself from half an acre. The Illinois Emergency Relief Commission last year provided garden plots containing 5,000 square feet each to many needy families, and in one section of 45.9 acres, 341 families raised 417,658 pounds of vegetables, an average production per plot of 1,420 pounds. Each family averaged about one-half hour of garden work daily for five months.

This provides a yardstick to measure the food your half acre will produce and the amount of time you must spend in your

garden to produce it. A liberal diet requires 752 pounds of vegetables per person per year, according to government fig-

ures, or 3,760 pounds of vegetables for a family of five. On the basis of the average production of the 341 families, about 13,650 square feet of soil should grow all the vegetables an average family needs. Let's add ten per cent for good measure, and make it 15,015 square feet.

The same figures indicate that you need average less than an hour and one-half per day in your garden for the five growing and harvesting months to produce nearly two tons of food.

But that is not all. The government estimates that 305 quarts of milk per person per year are needed in a liberal diet, or 1,525 quarts for a family of five. Two milk goats, living partly on vegetable tops from your garden and scraps from your table, will supply all your milk. The government also figures thirty dozen eggs per year are required in a liberal diet for one person. A flock of twenty-five laying hens, a dozen other hens and a score of young chickens will furnish all the eggs needed for five persons, plus about 125 pounds of meat

(Continued to page 119A)



Passengers or Freight Ride Smoothly in This All-Steel Trailer, Two Feet Wide and Thirty Inches Long, Easily Towed by Bicyclist

AIRPLANE-TIRED BIKE TRAILER HAULS FIFTH-TON LOADS

Fitted with small airplane tires that carry low pressure, the latest bicycle trailer is capable of carrying 400-pound loads with easy pedaling. The wheels have fully adjustable bearings and the axle has an end brace to support overloads. The body is all-steel, thirty inches long, twenty-four wide and twenty deep.

TILTING VISE FOR ANGLE WORK (1 T CAN BE SET QUICKLY

Lending itself to accurate setting without clamps, wedges or other make-shiftmethods, a new vise can be tilted for angle work. All the operator has to do is raise the vise to the required angle and lock adjustable supports. The tool is accurately

graduated, its base, body and sliding jaw are of semisteel cast and its adjusting screw has a fine pitch thread and long bearing in the vise body. The swivel base permits turning of 360 degrees. Drill press, milling

machine, grinder and bench vise work can be accomplished with the handy tool.

FINGER-TIP CONTROL RUNS ELECTRIC CAR FOR BOY CRIPPLE

Finger-tip control on the steering wheel for both forward and reverse motion and for brakes is provided on a small car built by a Wisconsin man for his crippled son. An automobile starting motor, slightly modified to operate on low current and to reverse, propels the tiny automobile twelve miles an hour with current from two six-volt

auto batteries. The wheels are driven by V-belts, arranged with just enough slip-page to allow smooth starting and differential for turning corners. The car is driven easily by the boy despite the fact that injury deprived him of the use of his



Automobile Starting Motor Operating on Two Six-Volt Batteries Drives This Tiny Car

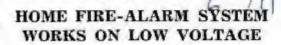
right hand and both legs. Batteries are re-charged overnight on an ordinary house circuit. One night's charging provides sufficient power for many hours of daytime driving. The builder estimated the cost of the car at not more than \$45.

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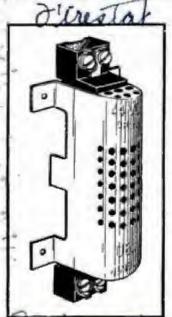
Flying Midget Plane Is Movie Star's Hobby

Building and flying model planes is the hobby of Reginald Denny, motion-picture actor. One of his latest midget aircraft is a scale model of a Fairchild monoplane. It is equipped with a onefifth-horsepower engine that gives the plane a speed of forty miles per hour and a ceiling of 9,000 efeet. Special construction features make the ship almost proof against damage in "crack-ups." The fuel tank holds two

ounces of gasoline, sufficient for flights of twenty-four minutes. When the tank becomes empty, the plane automatically assumes a three-point landing position and glides to the ground. The model is built of bass, spruce, balsa and duralumin, fabric covered. It weighs four and one-half pounds and carries a "pay load" of five pounds. The wing spread is seventy-one inches. Complete to plush-covered chairs in its cabin, the model has been tested by the actor, who plans to extend his hobby by producing the small ship commercially.



Less than twenty-four volts of electricity will operate a small fire-alarm system



designed for protection of the home. Five-inch fire detectors can be placed at strategic points; throughout house and garage. When a predetermined temperature is reached a loud gong is started. There are no fusible links or metals to be damaged and the unit is ready to be used again without repair,



Reginald Denny, Film Actor, with Model That Flies Forty Miles an Hour, Burning Two Ounces of Gaspline in Twenty-Four Minutes

AUTO BULBS FLASHING IN ORGAN PRODUCE MUSICAL NOTES

Ordinary automobile headlight bulbs connected with the keys and stops help produce the music in an electric organ operated on the principle of photo cells and light choppers. The organist playing the keys causes the lights to flash behind the light choppers, of which there are twelve,



Organ Operates on Principle of Photo-Electric Cell; Synchronous Motor Keeps It in Tune Constantly

driven by an endless belt from a synchronous motor. Each light chopper has six
rows of apertures for octaves, the "C"
chopper, for example, playing "C" at six
different octaves. The synchronous motor
keeps the instrument in tune, unaffected
by atmosphere of temperature.

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Corrosion Started by Salt Water and Air Would Soon Attack This Bridge if Crews of Painters Were Not Constantly on the Job

PAINTING GIANT FIRTH BRIDGE A NEVER-ENDING TASK

As soon as painters complete their threeyear job on the big bridge over the Firth of Forth, in Scotland, it is time to start again. Thus, the task is never-ending. It is necessary to keep the bridge well protected with paint to prevent sea water and salty air from corroding steel girders and other parts. The Firth of Forth is a narrow, arm of the sea on the Scottish coast-

AWNING WORKED FROM INSIDE ADJUSTS TO ANY POSITION

Operated easily from within the house, an awning is now being made which adjusts to any position—flat against the win-

olomoties

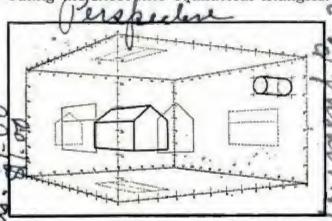
dow or flaring out to admit light and air. It rolls into a protecting hood at the top, and need not be taken down for winter storage. Less than a mindute is required to adjust its position

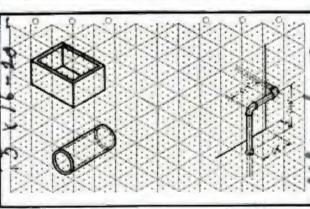
by means of a hand crank inside the room. The awning can be tailored to fit any window, and can be bought or leased.

LIFELIKE DRAWINGS MADE WITH LINED PAPER

Sketches in perspective and three-dimensioned mechanical drawings to scale can be simplified by using specially lined pa-> per. For the lifelike drawing there is a sheet on which a twelve-inch square transparent prism seven inches high is ruled in light green ink, serving as guide lines for any perspective art you wish to sketch in. For workmanlike scale drawings which ignore perspective. use an isometric lined page

per. As guides there are dots a quarter inch apart and parallel lines every inch, ruling the sheet into equilateral triangles.





Top, Perspective Drawing Paper; Bottom, Sheet Ruled for Three-Dimension Mechanical Drawing

Latest Autos Built to Make Servicing Easier

Auto manufacturers are fashioning the latest models so the servicestation attendant and the mechanic may reach vital parts more easily. For instance, the hood that opens from the side is being replaced by a hoodand-radiator grille unit that swings upward from the front to expose the entire motor instead of just one side. Pioneered several years ago by the maker of an air-cooled car, the front-opening hood is gaining ground as wider fenders make it harder for the mechanic to reach the engine. One of the latest aids to servlicing is a small door that opens on top of the hood near the ornament to permit filling the car with oil and water. This eliminates raising the hood unless the motor requires attention. Checking the oil level, formerly one of

the service-station operator's duties, is eliminated in one of the new models. The driver of the car may determine the oil level quickly by pressing a button on the



enortra Mis

Top, Hood and Grille Lift as Unit; Left, Fuel Gauge Tells Oil Level on Pressing Button; Right, Door in Hood for Water and Oil

instrument panel, converting the gasoline gauge temporarily into an oil gauge, Builtin jack pads for facilitating removal of tires are among other aids to servicing.

Cover to Warm Plane Engine Has Heater at the Bottom



Motor at Right Is Being Warmed by Heater Inside Cover

Designed to warm the motor while the plane is on the ground, a new cover has a heater at the bottom. The cover, which conveys the warmth from heating unit to the plane's motor and keeps it from escaping, extends from the ground and laces about the engine. Another innovation is an adjustable shutter for the motor that keeps out cold air while flying.

Used on Pacific Claskan



637/2

of the FAIRWAY

advantage over the feather ball-they went farther. For accuracy they were nearly as bad as their predecessors. On a hot day they would get soft and flatten out when hit and go hopping along like a rabbit with a sprained ankle. It is recorded that one especially warm day in 1896, the contestants in a tournament at a New York country club equipped their caddies with tins full of ice in which to carry their extra golf

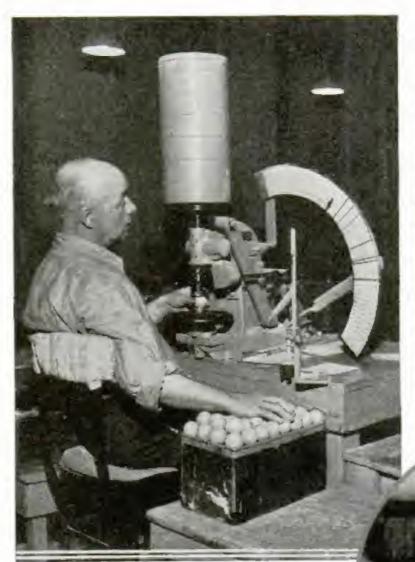




Top, Inspecting Finished Golf Balls; Below, Driving Machine Which Exerts Uniform Force and Is Used in Testing the Balls More Accurately Than Any Human Golfer Could Do It

balls to keep them from melting.

An American, Coburn Haskell, made the first golf ball wound with rubber thread thirty-seven years ago. Haskell reasoned that if he could make a ball of rubber thread it would have more resiliency and would stay round longer. He obtained the thread and after considerable difficulty managed to wind it into a ball. The ball was teed up and Joe Mitchell, a golfer of some prowess, was asked to try it. Mitchell, not knowing it was a new ball, hit it and nearly dropped dead



would go when hit is about 119 yards. Golf balls were made with smooth covers until the caddies on Scotch courses noticed that those which had been played and were cut as a result, went farther and straighter than new balls. The caddies then started cutting new balls with their knives. Recent experiments with a modern ball having a smooth cover indicated the longest drive possible with it was only 119 yards. Science explains it in this way. When a ball is hit properly it spins backward at a rate of from 4,000 to 7,000 revolutions per minute. This underspin, due to the recesses in the cover, creates an air cushion which tends to keep the ball in flight. The recesses are designed by ballistic experts who design the

for it sailed high over a wall, 200 yards from the tee—a wall which no one had ever driven over before.

This was the first really revolutionary advance in the making of golf balls. Today, Joe Mitchell's 200-yard drive is duplicated a thousand times a day by "duffers" all over the world. The longest drive on record today, made on an automatic driving machine, carried in the air 257 yards. The distance it rolled was not considered. The longest drive, roll not considered, under normal conditions by a human being is about 250 yards.

The golf ball of today is more than a piece of molded rubber attractively painted. There are as many as ninety operations in its manufacture and from thirty-five to fifty inspections. There are so many factors to be considered that eighteen days are required to complete one. One most important factor is the indentations on the cover of a golf ball. Without these indentations the maximum distance the ball

Top, Testing Resiliency under Pressure; Below, Centers Frozen in Molds to Insure Roundness

borings in rifles, and the molds used in casting the covers are checked to half of one-thousandth of an inch.

Another factor of importance is the tension at which the thread is wound onto the core. There is a distinct ratio between the tension and the distance the ball will go. The tighter it is wound the farther it will go. On the other hand, the tighter it is wound the easier the cover will cut. Designers have had to hit a happy medium between distance and toughness in de-

signing a ball for popular use. Many make a long-distance ball for professional use and a tougher but "shorter" ball for the average player.

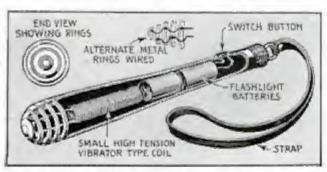
Many substances are used for the centers, including paste, water and glue. The paste center, made of gum acacia or the sap of the acacia tree, is one of the most satisfactory materials. Designers claim this paste or liquid center imparts more buoyancy to the finished ball. These bullets of the fairway travel at high speeds and with terrific force. One professional drove a ball completely through a telephone book one inch thick. After passing through the book it carried fifty yards in the air and rolled another fifty yards. He also drove the same ball through a one-inch pine board.

The golf club and the ball are together for a traveling distance of one-half inch or less and within that distance the ball attains a speed of about 114 miles an hour. The ball receives most of its resiliency from the manner in which the rubber thread is wound. The thread must be kept uniform and at a fixed tension. Machines have been produced which wind the thread automatically. The United States Rubber company has developed a process

(Continued to page 132A)

POLICE CLUB'S ELECTRIC SHOCK HELPS DISPERSE CROWDS

Delivering an electrical shock powerful enough to help disperse rioting crowds, a new police club is available for lawenforcing officers. It is made of bakelite, with six metal rings at one end. If a rioter comes in contact with the rings while the policeman presses a button on the handle, he receives a violent jolt. A small high-tension vibrator coil and small flashlight batteries produce the shock.



Sketch of Police Club with Button Which Wielder Presses to Shock Rioter

COIN-IN-SLOT FIRST-AID OUTFIT IN STREET PHONE BOOTHS



Demonstrating Stretcher and Medical Equipment Housed in Telephone Booth

First-aid outfits ranging from bandages and antiseptic to a complete miniature hospital may be obtained at telephone booths along Berlin's streets by dropping a coin into vending machines. The denomination of the coin varies according to the severity of the accident. In extreme cases, a completely equipped wheeled stretcher is available, together with every medical necessity for the most serious injury.

BOLT, RIVET AND NUT CUTTER WORKS IN CLOSE PLACES

Small enough to lay in the palm of the user's hand, a compact tool for cutting bolts, rivets and nuts exerts 10,000 pounds of pressure. It

of pressure. It weighs only two pounds. Bolts up to five-eighths inch diameter and nuts up to seveneighths inch diameter can be cut. The tool is easy to use in close quarters where other types of bolt cutters are useless.



& 315 magee

Million-Milers



went aloft to take a look. At 1,000 feet visibility closed in and Virden was left "flying blind."

He hesitated to come down again because of near-by mountains, so he climbed up and broke out of the clouds at 16,000 feet. He talked with Oakland by radio and found there was a 2,000-foot ceiling there, so he headed for Oakland on a compass course. He knew there was a cross-wind and tried to compensate for it. For three hours he flew until he was sure he must be over the Sacramento valley. He continued a while longer and finally spotted a hole in the clouds and glimpsed a lighted landing field through it. He came down, sure it must be the Oakland airport-and found himself on an intermediate field in Nevada, 150 miles distant.

It was then that he figured out that at the point when he first believed he was

PART II

COULD you hope to drive an automobile forty times around the world without so much as denting a fender?

Ralph Virden, pint-size pilot and one of the forty flyers for United Air Lines who has traveled 1,000,000 miles or more, holds a record as remarkable as that. He has flown more than 1,000,000 miles and never as much as scratched a wing.

Virden is one pilot who attests, by experience, the value of the directive radio beacon, the system which marks the course of airways by code signals. On a flight along the Pacific coast several years ago, before the installation of radio beacons, Virden landed at an intermediate field and sent his passengers by train because of threatening weather ahead. He was instructed to return to Oakland when weather permitted and as soon as the clouds seemed to be breaking up, he and his crew



Top, Heber Miller, Bundled Up as an Early Mail Pilot, and Al Smith, Wearing the Modern Uniform; Center, the Monomail of 1930, First Transport with Retractable Landing Gear; Below, Charles Peeples, One of the Million-Milers

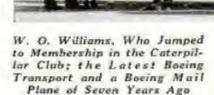
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above. There was no way to climb up and there was no way to climb down. Philosophically Ellis sat down to wait for something to happen. And it did. Someone at Rock Springs had seen him drop on the ledge. A few hours later a searching party reached the top of the mountain. A rope was lowered and Ellis and his mail were pulled up. The plane stayed where it was. The ship Ellis flies today has four times the horsepower of the one he left in a snowdrift on the top of White mountain.

Bill Williams, chief pilot of United's midwest division, is said to have the uncanny ability to handle a transport plane as smoothly as though it were being flown



just west of Rock Springs, a down draft of air caught his plane, and before he could right the little DeHaviland, he had been dumped into a twelve-foot snowbank about 200 feet below the mountain's summit.

Just before he hit, he cut his switch, pulled

back hard on the stick, and "pancaked" into the drift. It looked like a long, cold winter for Ellis. He was perched on a ledge with a 1,500-foot sheer drop below and the top frowned down on him 200 feet

by an automatic pilot. He learned to fly as a boy in Savannah, Ga., did border patrol flying with the Mexican expedition in 1916, entered an aviation unit during the World War and was graduated from the advance course of a French flying school the day the armistice was signed. To continue with his flying, he joined the air mail and soon after jumped into the Caterpillar club—a mythical organization of pilots who have been forced to bail out of their ships to save their lives. Williams was trapped one night when unexpected icing conditions logged down his plane. He jumped and landed safely with his parachute. In his only other accident, he stayed with the ship. A propeller shattered as he was taking off in Cleveland in 1926. The plane and pilot crashed but the flyer was unhurt.

James Lemont Brandon—"Monty" along the Cleveland-New York airway—has a record that reads like a fiction thriller. He might be called an international pilot. Some twenty years ago he joined a cavalry regiment but found airplanes were faster than horses, so in 1916 he transferred to the Canadian Royal Flying Corps, went to England for training and was placed in charge of combat instruction at one of the aviation training camps abroad. There he was pigeonholed until the armistice. Then he flew in Turkey and Greece, and later became a captain in the White army in Russia. He returned to the

(Continued to page 128A)

BOTTLE LABELER FOR HOME IS EASY TO OPERATE

Scarcely larger than a cigar box is a hand-operated machine for applying labels to bottles. Because of its economy it



is particularly adapted to small industries or home use. After the wet gummed label is laid on the bottle, it is pressed gently against a flexible rubber belt held by two protruding arms. The pressure causes a compound

other, wrapping the label around the bottle tightly and evenly without wrinkling so that no additional smoothing with the hand or cloth is necessary.

TINY POWER-DRIVEN PLANE IS TESTED IN WIND TUNNEL



These Propeller Blades Traveled Faster than Sound When Driven by Motor in Wind-Tunnel Test

Wind-tunnel studies of the performance of propellers were made at California Institute of Technology by installing a twelve-horsepower electric motor to drive a three-blade miniature propeller on a model plane. Army and navy aviation experts were investigating propeller wash and its effect on stability, using a low-wing monoplane one-sixth normal size. With the engine driving at 12,000 revolutions a minute, it was estimated the tips of the blades traveled more than 1,130 feet a second, faster than sound waves.

TENNIS BALL GIVEN LONGER LIFE BY RESTORING NAP

Restoring the nap of a worn tennis ball extends its life and brings back the heavier "feel" of the new ball. With a rotary.

napper operated by a hand crank the nap can be renewed. As the fuzzy covering of a ball wears down and mats, the ball seems to lose weight, but tests have shown that



less than one-tenth of one per cent of weight is lost every ten games. Stirring up the nap restores the air resistance and the accuracy and control of the new ball.

sardner sarra



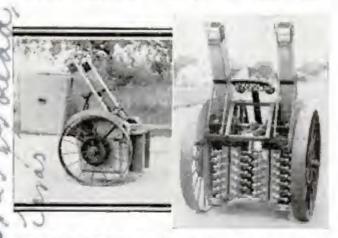
Port Official in Office Fitted with Ship's Wheel and Compass to Give It a Maritime Atmosphere

PORT OFFICE LIKE PILOT HOUSE OVERLOOKS SHIP CHANNEL

Eighty miles inland from the Pacific ocean, the Port of Stockton, Calif., has been visited by more than 500 deep-sea vessels since it was opened early in 1933. Among its features is the director's office which resembles the pilot house of a ship, even containing a full-size ship's wheel and a compass. Triangular in shape, it overlooks the main channel on one side and the shipping activities in one of the slips on the other. An enclosed bridge permits access to the office.

IRON FINGERS PICK COTTON WITHOUT HURTING PLANT.

Revolving fingers of iron on a mechanical cotton picker go over the plant like a fine-tooth comb and harvest the cotton without injuring foliage or stem. This



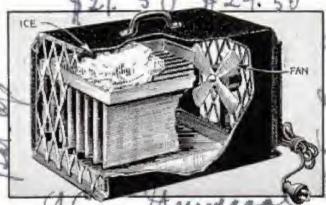
Left, Basket Set to Receive Cotton from Conveyors; Right, Picker Arms Shown on Slats between Wheels

reaper, invented by a Texan, can be drawn by horse or tractor. As it moves along the row, power transmitted by a belt from the two wheels keeps a dozen slats moving backward on each side of the plant. Six picker arms, with tiny revolving points that collect the cotton from the open bolls, are mounted on each slat. The backward motion of the slats equals the forward motion of the wheels, thus preventing any tearing of the plant. As the arms travel around the back and past the wheels on each side they reach a conveyor. the revolving points reverse direction and drop the cotton which

is carried up and dumped into a detachable basket behind the driver's seat.

ROOM COOLED BY ICE AND FAN IN PORTABLE UNIT

Taking in the air at one end and expelling it at the other after removal of much of the heat, the latest room-cooling unit is



Cutaway View of Portable Room Cooler That Operates Cheaply on Ice

inexpensive to operate. It has a small motor and fan for forcing air over an ice shelf and through nine partitions of a "heat transfer element" at the rate of 200 cubic feet per minute. Only two pounds of ice will start the machine's cooling stream of air, this amount lasting one hour. Fins in the cooler hold the low temperature much longer, however. Any kind of ice may be used. Cost of electricity is less than one-fourth cent per hour. The machine weighs only twelve pounds and is sixteen inches long. It plugs into any convenient light socket.

GAR WOOD'S Mystery

BOAT:

I T is more powerful than three locomotives! It contains the largest man-made bolt of lightning! It digests its food at the rate of more than 700 feet per second! It swallows 480 gallons of oil an hour! It drinks 600 gallons of water a minute! It is the fastest thing of its kind in the world!

It is Garfield A. Wood's Miss America X, holder of the world record for speed on water and present possessor of the Harmsworth Trophy, emblematic of the championship in marine racing.

When you consider Miss America X, think of a thundering 7,200-horsepower plant, of rotors

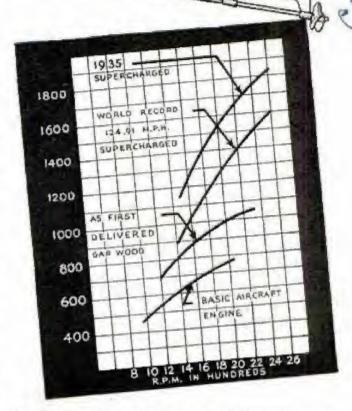


MISS AMERICA X

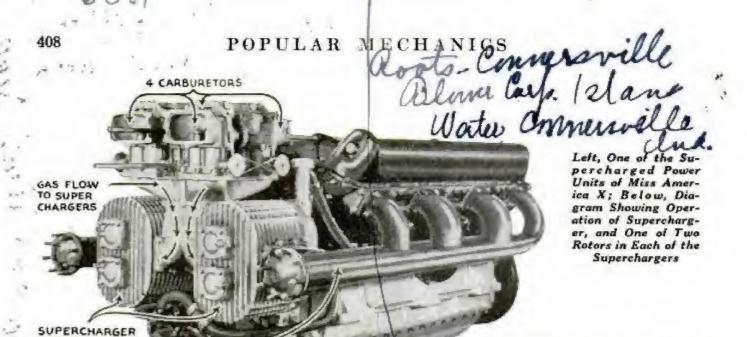
in four giant superchargers whirring at 6,400 revolutions per minute, of air and gas being compressed into chambers and shot into manifolds under a total pressure of forty-two pounds, of crankshafts so timed that there are twelve explosions every time they revolve, of pistons as large as old-fashioned round paving blocks jumping up and down thirteen inches in cylinders as large as cuspidors and of ninety-six spark plugs giving 124,800 detonating sparks every minute.

The boat's present power plant, as originally designed, had a total horsepower of 3,000. The New York Central's finest locomotive boasts 2,109. Today three such locomotives wouldn't match the Miss America's power.

The achievement dates from 1932 when Wood, almost beaten in 1931 by the Britisher, Kaye Don, determined to put four Packard marine-converted motors into one hull which he called the Miss America



Gar Wood and One of Miss America's Superchargers; Cutaway of Boat and Engine Horsepower Curves



MANIFOLD

X. Packard engineers already had increased the engine speed of the motors so they were pulling 1,100 horsepower instead of 770. The 4,400-horsepower total, however, was not enough for Wood. He installed four low-speed superchargers designed by Louis Schwitzer of Indianapolis and boosted the horsepower to 6,400. Kaye Don was beaten easily and the boat set a new world record of 124.86 miles an hour.

HOUSING

Before the boat would perform, Wood had to solve two problems, the hooking up of the four motors and the balancing of the hull to carry the power. M. J. Steele, Packard's chief engineer, helped him solve the first problem by arranging the motors in tandem, two and two, and connecting their power through gear boxes. Engineers did not think two crankshafts could be synchronized. Wood, by splining the shafts in each gear box, proved it could be done. Then he had to synchronize the time of the twenty-four cylinders in each bank to make the two engines fire as one motor. As single twelve-cylinder jobs they had fired every sixty degrees but never had two motors been hooked up and so synchronized that the firing would take place every thirty degrees. By rotating the shaft of one thirty degrees as compared to the other this was done and the two were working as a unit! Previously motors had been hooked up but always their crankshafts had turned separately into the gear

SUPERCHARGER MANIFOLD CARRYING MIXTURE TO EACH BANK OF CYLINDERS FROM MANIFOLD PRESSURE CARBURETOR OF 101/2 LBS. DUE TO SUPERCHARGER ACTION GASOLINE AND AIR AT 2,600 ENGINE R.P.M. SUCKED THROUGH CARBURETOR BY ROTORS RUN AT 6400 R.P.M. SUPERCHARGER AT 2,500 ENGINE R.P.M.

box. Picture what goes on inside the two banks of four motors when Miss America's engines are running wide open at 2,600 revolutions a minute. Four valves to every one of the forty-eight cylinders, ten springs to every valve, these valves traveling up and down at the rate of better than 2,000 miles an hour! With a stroke of six and one-half inches, the forty-eight pistons, traveling up and down thirteen inches, move an equivalent of more than 1,500 miles an hour.

There are two spark plugs to every cyl-

8381

POPULAR MECHANICS

inder and each delivers a spark every other crankshaft revolution. Each plug fires 1,300 sparks a minute, the ninety-six plugs firing 124,808 sparks per minute. Each spark is twenty-five one-thousandths of an inch long—a three-mile long spark for a single hour, surely the longest manmade bolt of lightning in the world!

The "breathing" capacity of Miss America X is equivalent to that of 32,800 average human beings. Every revolution of a crankshaft takes in 1,270 cubic inches of air and at 2,600 revolutions a minute, each engine breathes 1,910 cubic feet and the superchargers increase the air "breathed" to a point where all four motors take in 656,000 cubic feet an hour. This is 46,000 pounds of air an hour for the four motors. The average human breathes about twenty cubic feet per hour.

Wood had the power. Now to employ it. He had to build a hull to take it, and it

(Continued to page 136A)

GLIDER LAUNCHED FROM CLIFF ON GREASED-PLANK RUNWAY

Launched into space by sliding down a greased plank, a glider took off from the brink of a 1,000-foot precipice in the state of Washington and landed safely. The board runway, about twenty feet long, slanted toward the abyss from the top of an automobile.



For Runway in a Daring Dive from the Crest of a 1,000-Foot Cliff, This Glider Used a Greased Board Attached to an Automobile

LIGHT STRAPPED TO THE WRIST LEAVES TWO HANDS FREE



Work Around Home and Car at Night Is Easier When Wrist Light Sets Both Hands Free

Shaped to fit the wrist, a small flashlight that can be strapped to either arm sets both hands free to work. The motorist or mechanic finds it useful as a third arm when tinkering in the dark. Farmers de-

ing late chores, sportsmen reeling in brook trout when twilight darkens the woods, or the home owner working in basement or garage, all find uses for the wrist light. When not strapped to the wrist, it can be used as an ordinary flashlight, and by means of a small wire handle it can be hung or propped to point up or down as needed.

¶Inquiries as to makers
of articles described in
Popular Mechanics, will
be answered by our Bureau of Information on
receipt of a stamped,
self-addressed envelope.

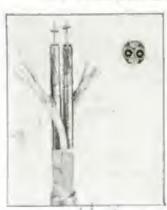
Tiny Catwalk on Big Bridge Holds Men Spinning Cables



During Workers Are Shown Stretching Narrow Catwalk That Will Be Used in Stringing Cables to Support Big Bay Bridge

Four hundred and fifty feet above the water, workmen braved death to string the mesh flooring for the tiny catwalk on which other daring men are stringing the miles of cable for the San Francisco-Oakland Bay bridge. From this narrow walkway, 71,000 miles of cable wire will be stretched to support the giant bridge. The cables, twenty-eight and three-fourths inches in diameter, will support greater loads than the mighty span ever will be required to carry between the two cities.

TWO HUNDRED CALLS CARRIED ON ONE TELEPHONE CABLE



Simultaneous transmission of 200 conversations over one circuit is possible with a coaxial cable developed at the Bell Telephone laboratories. Ordinary telephone lines in use today

can carry four conversations. The coaxial cable. capable of conducting frequencies as high as 1,000 kilocycles, is adapted to the transmission of television and the linking of broadcasting stations long distances apart, and will be useful for longdistance telephone service when additional channels are required. At the sending end, conversations from 200 lines are gathered together on the single coaxial line, then separated at the receiving end and sent along on 200 other cir-

BANK TELLER'S VEST HIDES CAMERA TO SNAP SUSPECTS

If a suspicious-looking person cashes a check at the "paying" window, the

teller may snap a photograph of the "suspect" if a new camera is adopted for use in banks. The camera, which is small, is fitted with a cowl that is inserted into the buttonhole of the teller's vest and the



Tiny Camera That Is Concealed by Teller's Vest When Ready for Operation

camera is pinned on the inside of the vest. A tube from the camera extends within a few inches of the teller's fingers to facilitate snapping the photograph. Thus, instead of trying to remember the features of a suspect, the teller can produce his small photo to aid police. The camera operates silently.

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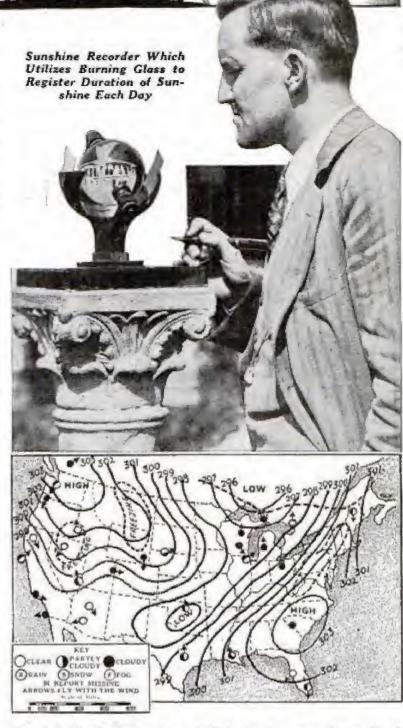


PART II

THE amateur weather forecaster who has taken up the drama of the weather as an exciting hobby will find the daily maps made up by the weather bureau are vivid pictures of weather conditions not only in his own locality at the moment, but of the weather that is coming within the next twenty-four or thirty-six hours.

They are an invaluable supplement to his own forecasts from a regular reading of his barometer and his observations of the direction of the wind. Knowing the simple rules for the direction of the winds around the barometric "lows" and "highs," he can easily figure what is likely to happen in his particular district when the map shows it is already under the influence of a high or a low, or that one of them is drifting in his direction.

The map is simply a graphic picture of the outlines of those big pressure areas. It is, in fact, the weather's fingerprint record at the moment the map was made, which is generally eight o'clock in the morning or eight o'clock in the evening. The waving, curving, parallel lines traced over the face of the United States are called "isobars." They are the actual outlines of the various stages of the high and low areas, for they run through the principal weather stations that have the same baro-



Typical Weather Map from Which Amateur Can See Drift of "Highs" and "Lows" and Make His Own Forecasts

Left, Mensuring Rainfall; Below, Barograph Which Keeps a Chart Record of Changes in Atmospheric Pressure

Consideration the effect the at-



Observatory in Washington Weather Bureau, and Map Showing Storm Paths during Summer Drought of 1934

As those pressure areas drift across the country in a general west-to-east direction, they usually alternate—first a low and then a high. It is the weather man's business to estimate how fast and in what direction a given pressure area will move. To do this yourself, you must take into

tendant winds will have on the atmosphere in your own locality, for you know that if a low in a certain position is sweeping warm winds from a southerly direction toward you, the temperature is going to rise, while a different pressure area will normally shoot cooler or cold winds from the north toward you, and the thermometer is bound to drop.

Taking wind direction into consideration, you are prepared to issue a forecast-to yourself, if to nobody else—on the probabilities for the next twelve hours or so. You may be wrong, of course. Even the forecast experts, who have spent years studying the weather, are wrong about fifteen per cent of the time. But it is fun to pit your skill and knowledge against the huge atmospheric disturbances that make up highs and lows, and to see how many times you are right. Sometimes you may even hit it right when the official weather man fails, although you are more likely, as your skill de-

velops through experience, to reach the same conclusions he does.

Some newspapers in the larger cities publish the maps daily, or the weather bureau in the nearest large city will supply a map service six days a week for twenty cents a month. If you want a map that shows the highs and lows outside the

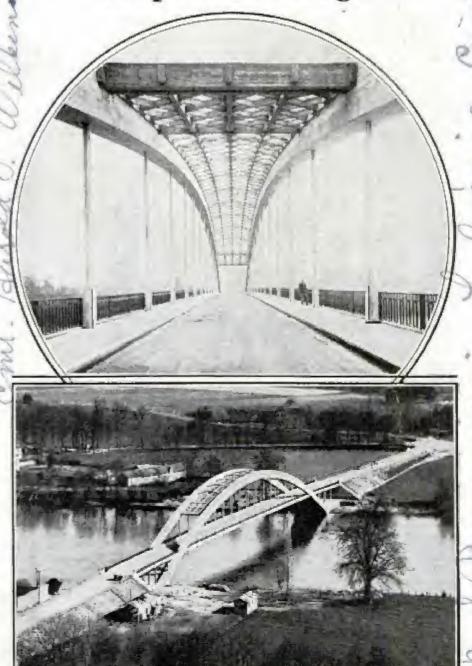
United States, and comes 365 days a year, it can be obtained from the weather bureau in Washington for three dollars a year. The money must be sent by check or money order, as currency and stamps are not accepted.

You can increase your enjoyment if, when you receive your map, you refuse to look at it until you have examined your own barometer, inspected the drift of the clouds or the pointing of the weathervane, and made your own forecast. Then look at the official prediction and see how close you come to being right.

Once you begin to seehow the weather works, you become fascinated and want to know more. Before you know it, you have invested in a barograph to do your pressure recording for you. A barograph is simply a barometer that traces the pressure stages of the atmosphere on a revolving chart. Then you want a hygrometer to keep charts of the humidity. None of the instruments for deeper studies is prohibitively expensive. A satisfactory barograph can be bought for as little as \$50, and a hygrometer for \$3.50.

But those studies come later. In the beginning it is better simply to keep a regular record of your barometer, observe the direction of the wind, and try making your own forecasts. If you want a simple and non-technical introduction to your hobby, write to the government printing office in Washington for a booklet on "Weather Forecasting" by Meteorologist George S. Bliss. It costs only five cents and offers much useful information for the person starting to follow the weather as a hobby.

One Concrete Span Supports Suspension Bridge



Top, Looking Along Roadway Which Is Supported by Single Concrete Span; Bottom, Distant View of the Unusual Bridge

Unusual in that one single span of concrete supports the roadway, a suspension bridge recently has been opened to traffic over the river Seine. The span is the single-arch type, 528 feet long, with massive blocks of concrete serving as abutments at each end of the bridge. Transverse crossties of wood, together with trellis work supported by intermediate spans, take the thrust of the wind against the middle of the concrete span and transfer it to a point under the floor.

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Plane Built Like Odd Insect Keeps Level in Any Weather



This Looks Like a "Crack-Up," But It Actually Is an Odd Pusher Plane Fitted with Vertical Tail Instead of Horizontal

Unusual in its light weight, the latest airplane resembles an insect known as the "elytrope" because the tail assembly is vertical instead of horizontal. The weight is only 440 pounds. It is driven by a twenty-five horsepower engine. Developed by M. de Rougie of Paris, the plane is said to be capable of maintaining a horizontal position in all kinds of weather, not being affected by cross currents of wind as are conventional planes. The designer conceived the idea while watching the elytrope's flight.

FEW PLANT PATENTS GRANTED IN LAST FIVE YEARS

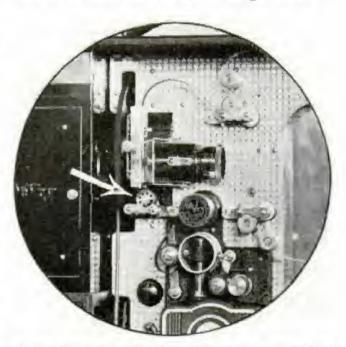
In comparison to the thousands of patents on mechanical devices, only 124 patents on plants have been issued since the law went into effect in May, 1930. These patents have been divided into four classifications: roses, other flowers, fruits and "plants," the latter being a catch-all for everything not classified as either flowers or fruit. Aside from roses, patented flowers run strongly to carnations, dahlias,

chrysanthemums and freesias. Among patented fruits, apples, plums, grapes and avocados are conspicuous. There is one patented mushroom.

THEATER TYPE DRIVE USED IN PROJECTOR FOR HOME MOVIES

Sprocket movement similar to that used in professional motion-picture projectors is now available in a home projector. Ordinarily, home movie film is driven by a claw movement in the projector, hammer-like blows into the film perforations carrying the ribbon along. The sprocket intermittent type being built in a sixteen-millimeter projector has a smooth rotary motion, and is adaptable to sound movie film which can be

perforated only on one side. The projector also has a silent chain drive, a double exciter lamp socket which prevents interruption if a lamp burns out, and an illuminated radio-type dial on the sound box. It can be used for homes or large halls.



Arrow Shows Sprocket Intermittent Movement Used in Hame Movie Projector with Sound Attachments

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Nurses Wear Grotesque Masks for Gas Drill



Looking Like an Assemblage of Monsters or Human Death's Heads, These Are Really English Student Nurses Being Trained in the Use of Ggs Masks for Protection during Wartime Attack

When instruction was given English girl nurses recently about what to do in a gas attack by the "enemy," scores of pretty faces were hidden behind grotesque masks. The training course was a part of the na-

tion's program for preparing the public for the terrors of war. Military experts expect poison gas to be used generally in the next war and European governments are training their citizens for defense.

Casting Larger Than Man Built to Aid River Deepening



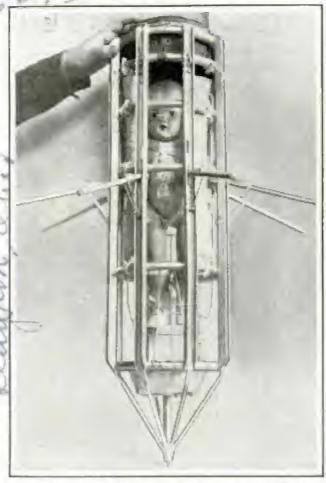
This Revolving Dredge Cutter Head, More Than Seven Feet Tall, Was Specially Cast for Use on Channel Deepening Project

To dredge a deeper channel in the bayous around New Orleans, a special casting of intricate design, resembling a ship's propeller in appearance, was "tailored" to order in a Chicago foundry. The dredge cutter head of alloy steel is seven feet and two inches in diameter, five feet and eight inches long, and weighs 9,424 pounds. The blades revolve about a square shaft, taking a big bite of river bottom each time. The dredging is part of a government project on a tributary of the Mississippi.

ind. P.g. Bauer

58

Hariford Conn



Parachute, Pneumatic Shock Absorber and Rods at Side Protect Patient When Cage Drops from Plane

'CHUTE FOR INJURED PERSON TESTED IN MODEL FORM

For lowering injured persons from disabled airplanes, army air corps engineers at Wright field have developed a parachute device that has undergone severe tests. Built in model form, it consists of a close-fitting padded cage for the standard airplane litter, with a thirty-foot parachute packed in the top. As the injured person's

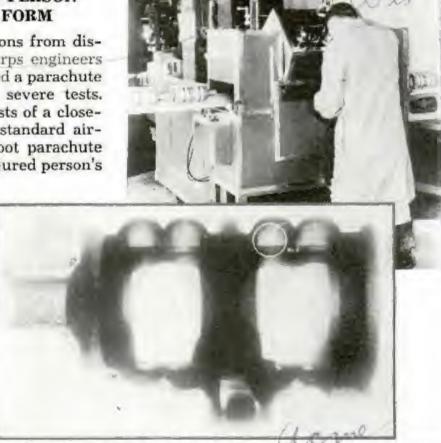
cage is released from the plane, the parachute is jerked open by a breakable cord attached to the ship. The litter protector is tapered at the bottom, ending in a pointed rod intended to anchor in the ground on impact. Between the foot of the litter and the rod is a pneumatic shock absorber. Spring rods resembling the ribs of an opened umbrella encircle the cage radially to prevent it striking the ground flat.

PLASTIC ASBESTOS LIKE PUTTY SOLVES MENDING PROBLEM

Plastic and therefore easy to handle, an asbestos filler solves the problem of mending cracks and holes in woodwork, roofs, gutters and many other places in the home. The putty does not crack or dry out and contains no oil. It takes paint easily and is waterproof, acid-proof and non-inflammable. The filler also can be used to advantage in calking boats, large or small.

X-RAY VIEWS MOVING PARTS TO CATCH HIDDEN FLAWS

Hidden defects can be caught along the production line by means of an X-ray machine which gives its operator an interior view of the product while it moves along. X-ray photographs hitherto have shown the inner structure of stationary metal castings, canned goods and similar solids. Peering into the eyepiece of this X-ray instrument, however, the inspector can keep watch on a moving belt to catch flaws in manufactured articles before they reach the shipping froom.



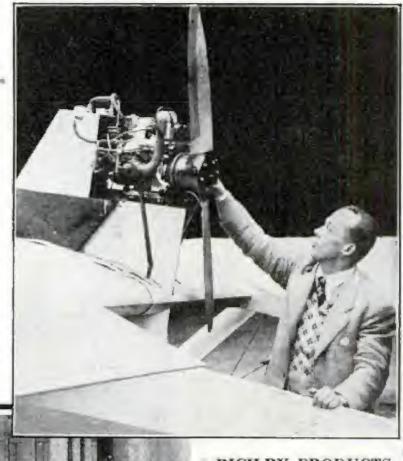
Top, Inspector Watches Products on Production Line Moving through X-Ray Machine; Bottom, What Operator Sees; Circle Shows Flaw

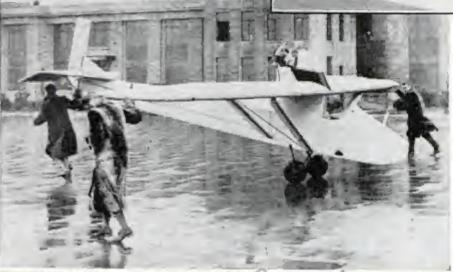
adrian X:

POWER GLIDER CROSSES CHANNEL

Motorcycle Engine Drives Tiny Craft from London to Paris

Powered by only a light motorcycle engine, a glider has conquered the English Channel. Total cost of gasoline and oil was only \$1.50. The pilot, Robert Kronfeld, Austrian gliding expert, not only flew the channel, but negotiated the distance from Croydon airport, located near London, to Paris, France, an air-line mileage of 210 miles, in less than five hours. Uncertainty of weather over the channel always has made hazardous any attempt to cross from England to France by glider, since craft lacking motors depend entirely upon lifting air currents and are at the mercy of cross winds. With his small motorcycle engine, rated at only five horsepower, the Austrian pilot was able to maintain the glider at a safe level and





Top, Small Pusher Motor with Which Glider Is Propelled; Bottom, Wheeling the Motor Glider into Hangar after Trial Flight

on its course. The addition of a motor actually converts a glider into a light airplane, with an unusual wing spread.

■Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

RICH BY-PRODUCTS PASS THROUGH BROMINE PLANT

If by-products in sea water that passed through the Ethyl-Dow Chemical company's bromine plant in one year could have been extracted and sold, the company would have been \$50,000,000 richer. In the 140,000,000,000 pounds of sea water pumped through the plant were: 750,000 tons of common salt; 450,000 tons

of Epsom salts; 90,000,000 pounds of metallic magnesium from which could be constructed 90,000 modern airplanes; one \$20,000 cube of gold; eighty tons of strontium; eight and one-half tons of copper; three and one-half tons of iodine; potassium to make 1,000,000 tons of fertilizer, and eighty tons of calcium chloride. The bromine is used in anti-knock gasoline.

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making HOME TASKS





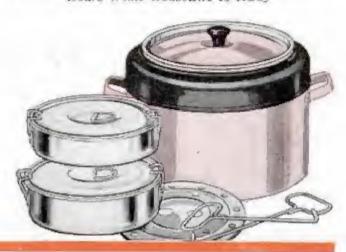
Top, Right, Water Boils Almost Instantly in This Teakettle; at Center of Its Interior Is a Cone, Point Upward, with Corrugated Sides That Greatly Increase the Amount of Heat-Radiating Surface in Contact with Water; Direct and Radiated Heat Passes Up Inside Cone



Top, Combination Shower and Spout with Elbow Joints Is Easily Adjustable to Convenient Positions at Height of Man or Child; Slight Turn Converts Spray into Solid Stream for Filling Tub; Bottom, Silverware Can Be Kept Constantly Bright by Placing a Chemical, Available in Attractive Jur, in Cabinet or Chest with It to Absorb Hydrogen Sulphide, Cause of Tarnish, Irom the Air

Above, Right, to Connect Faucet with Hose for Washing Machine, Garden, Bath or Vegetable Spray, Adapter Is Pushed into Faucet and Lever Thrown, Which Presses It Firmly in Spout; Bottom, Right, Two-Heat Electric Casserole Uses 100 or 325 Watts, Retaining Natural Food Juices; Dinner Can Be Left Cooking Slowly for Hours While Housewile Is Away



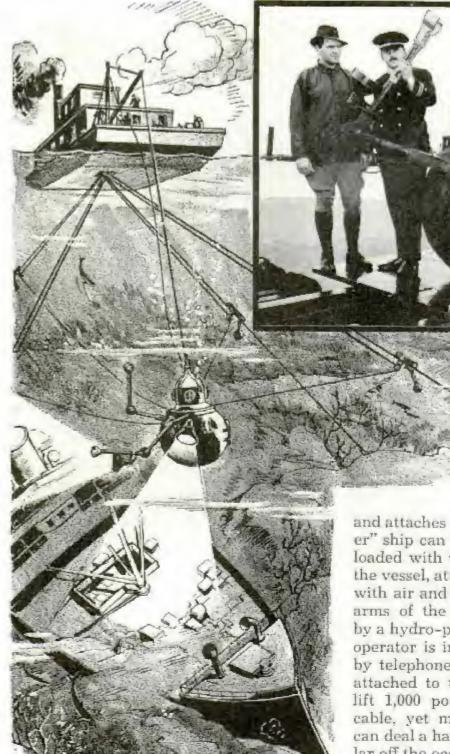


a PLEASURE



AR MECHANICS

Robot Diving Ball to Speed Deep-Sea Salvage



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Top, Diving Ball Is Ready for Ocean Treasure Hunt; Note Giant Arm and Searchlights Worked from Within; Left, Drawing Shows How Cables Manipulate Ball over Wide Area While "Mother" Ship Is at Anchor

Termed by navy inspectors "the greatest invention since the diving suit," a diving sphere with two giant arms designed for commercial salvage work has met tests at depths beyond 800 feet. The ball weighs two tons and can withstand pressure 2,500 feet down in the ocean. Guided by searchlights, its operator locates the sunken ship, then bores through its plating with a drill

and attaches cables with which the "mother" ship can hoist the wreck. Metal tanks loaded with water are sunk to the side of the vessel, attached to it by the diver, filled with air and floated, raising the ship. The arms of the diving ball are maneuvered by a hydro-pneumatic mechanism, and the operator is in touch with the mother ship by telephone. Twelve implements can be attached to the six-foot arms. They can lift 1,000 pounds and tie knots in steel cable, yet manipulate so delicately they can deal a hand of cards or pick a half dollar off the ocean floor. The diving ball was built to recover treasure, to aid in floating wrecks and in submarine rescue work, Oxygen tanks and carbon-dioxide absorber permit the diver to remain under sea twelve hours. The ball can be worked over a wide area of sea bottom while the mother ship is stationary. Anchors are dropped at four corners. From the anchor cables hang other cables by means of which the sphere can be manipulated vertically and horizontally.

MOVABLE PLATFOR

Radio Paris

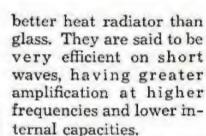
Metal Tubes and Midget Acorns

A LTHOUGH metal radio tubes have been on the market in Europe for some time they are quite new to us. Improved American-made tubes of this description will be used in several all-wave receivers soon to be announced.

They are smaller than ordinary glass tubes used for the same purposes, as will be noted in the photo at the right. These tubes require special sockets and are not interchangeable with standard types. About ten varieties have been made including a new type which has two cathodes

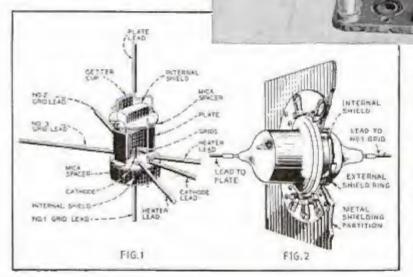
and two diode plates.

The base pins are all the same size and a center key-plug extends down through the socket. These all-metal tubes are self-shielded and have 6.3-volt filaments. The shell is made of thin iron which is a



The midget "acorn" type tubes, shown in the

lower photo, are available to experimenters but do not appear in commercial receivers at the present time. They are especially designed for ultra-short wave operation; amateurs and experimenters are using them on wavelengths as short as 0.7 meter. The internal structure of the RCA type-954 detector-amplifier pentode is shown in Fig. 1 and a suggested method for shielding in Fig. 2.



How to build an inexpensive

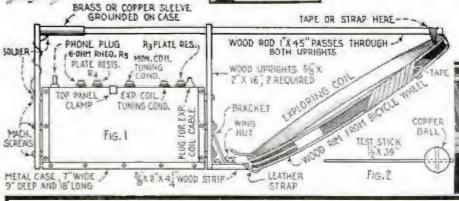


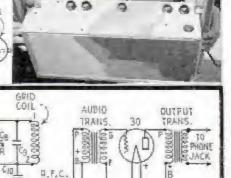
By BEN A. ELLIOTT

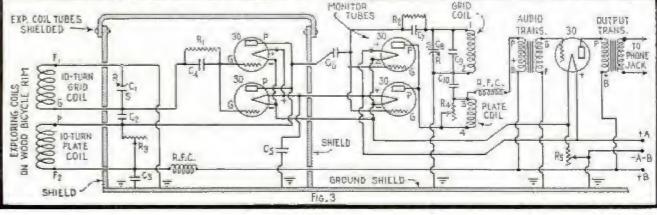
BURIED or hidden metals are easily located with this practical radio exploring device. It provides a sensitive instrument for treasure hunting and has many other useful applications. The metal detector to be described was designed originally for the purpose of locating buried shut-off boxes on the campus of one of our large state universities:

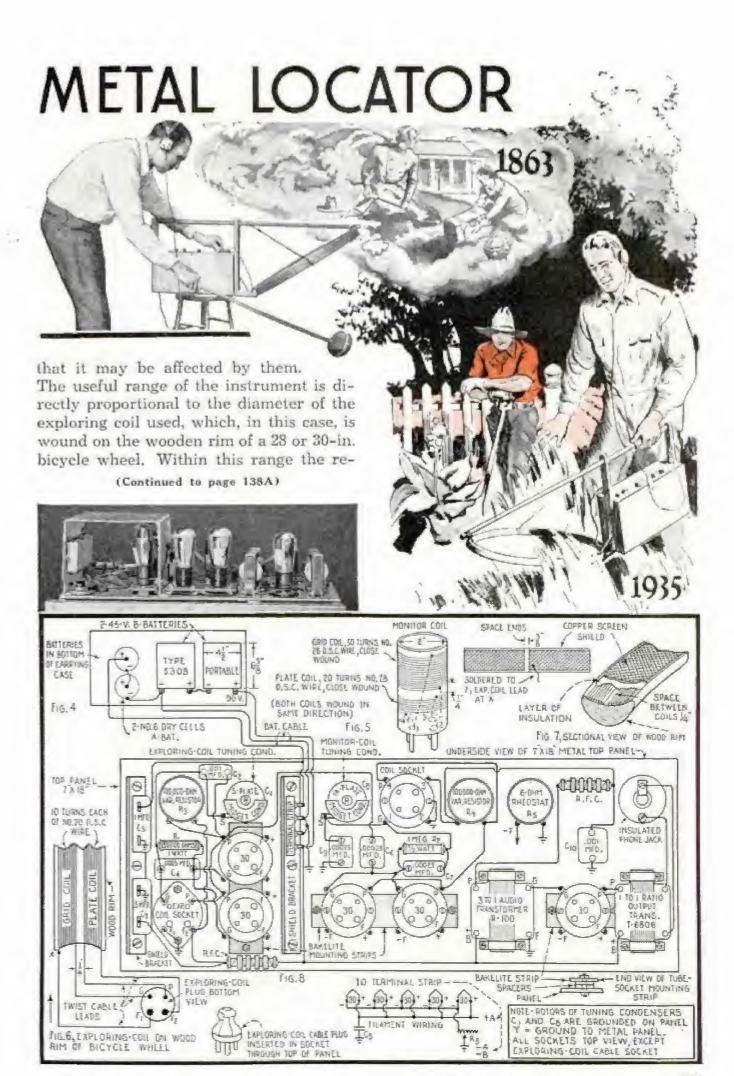
Concealed pipes and light wires may be located quickly without tearing out large wall sections in preliminary investigations. In common with any other exploring device in use today, it must be brought with-

in a reasonable distance of the pipes, wiring, treasure or ore deposit in order









ANTENNA INSTALLATIONS

Part II

OCATED at any convenient point near the set, the through-the-wall perma-

> nent lead-in unit, previously mentioned, provides a good outside ground connection for the receiver as well as other desirable features.

> Those who prefer to use a separate rubber-covered wire for the lead-in must be sure that it is soldered securely to the flat top portion of the antenna. A poorly soldered connection at this point will

cause signal losses, therefore the continuous wire referred to in Part I of this article is preferred.

For temporary installations, the lead-in wire may be brought into the building by means of an insulated flat metal strip, known as a "window-strip lead-in." This is placed on the sill and the window is closed down upon it. These strips are provided with spring clips at each end.

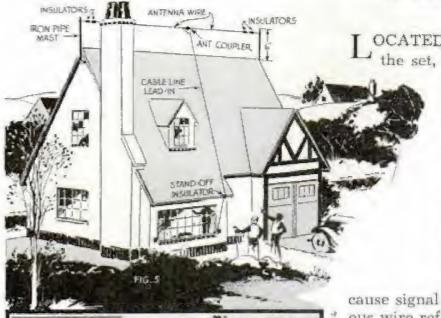
Another method is to bring the lead-in wire, without a break, through a porcelain-tube insulator inserted in a hole drilled through the side of the building or window casing. The hole should be drilled slightly larger than the tubular insulator and should slant down toward the outside so that rain cannot enter.

The inverted L-type antenna will give satisfactory results in average locations. However, if troublesome interference from electrically operated apparatus in the home should be picked up by the lead-in, it will be necessary to employ a

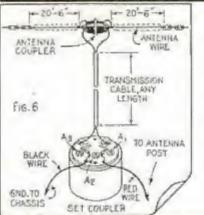
noise-eliminating lead-in system. There are several varieties available both in the shielded and transposed-feeder forms that may be used with the L-type antenna.

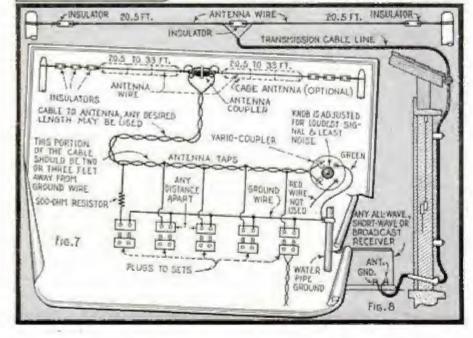
In really noisy locations, especially where an all-wave receiver is used, the best results are obtained with one of the newer all-wave noise-reducing doublet antenna systems. This type of installation is illustrated in Fig. 5. A clear space of about 50 feet is required,

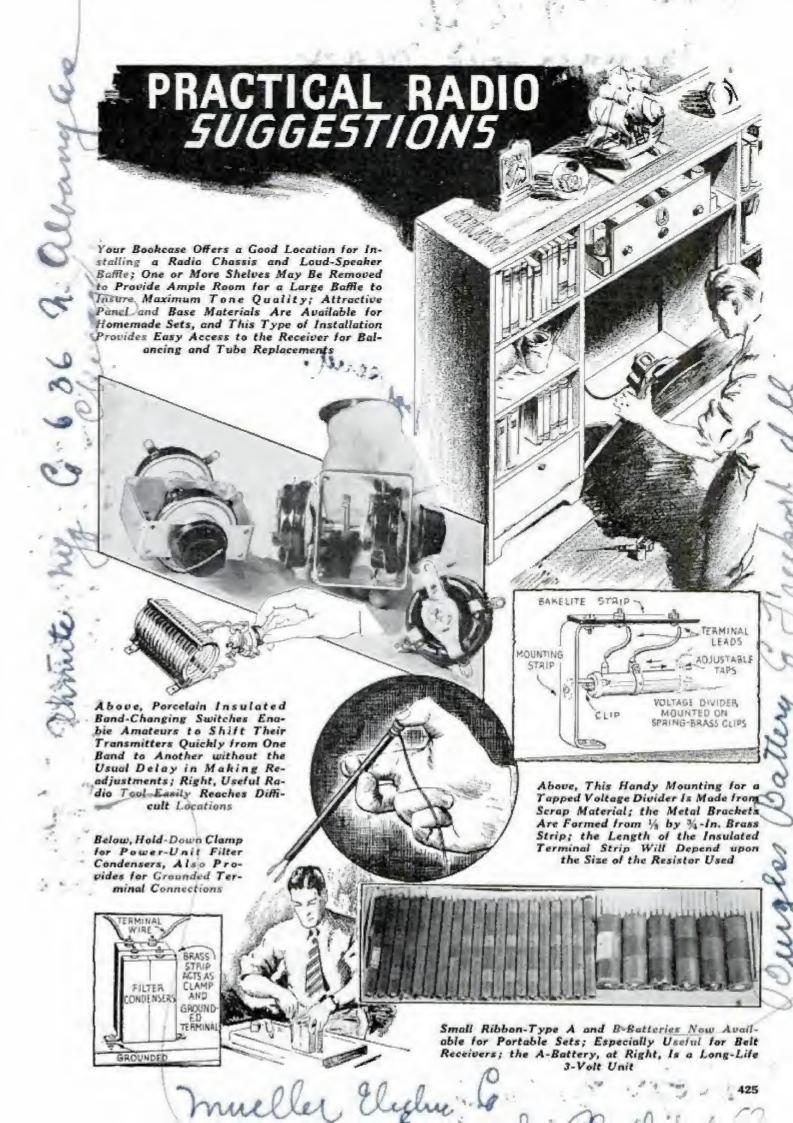
(Continued to page 140A)

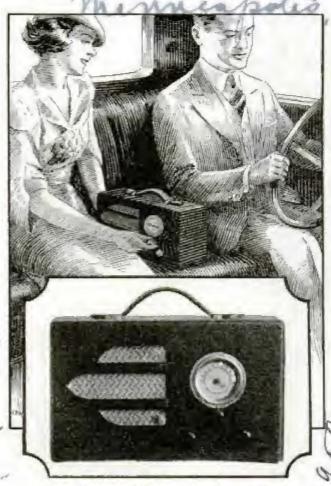












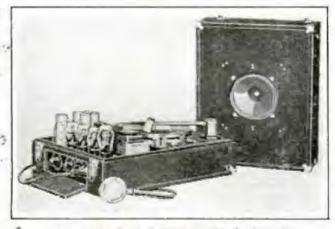
Dual-Purpose Receiver for Car or Home

Portable Set Operates from Car Battery

No B or C-batteries are required for this portable receiver. It may be operated directly from the 6-volt storage battery in the car, or on a 110-volt a.c. line if desired for use in the home or hotel room. A special plug-in arrangement automatically makes the necessary changes from 6 to 110-volt operation.

Compact Amplifier and Phonograph Unit

. This compact unit consists of a portable sound system with a built-in power am-

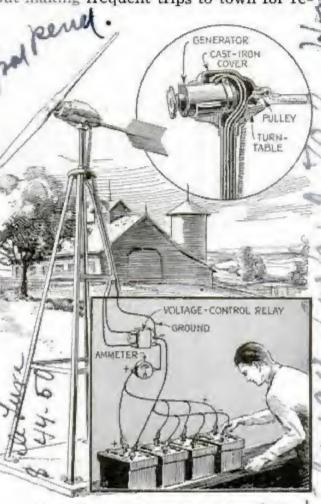


Complete Sound System Ready for Use

plifier the output of which is rated at 7 watts from a crystal microphone input. It includes mixing controls for the microphone and phonograph, with a choice of output impedances and field supply for dynamic speakers.

Wind-Driven Charger for Radio Batteries

Several ordinary radio or auto batteries can be kept fully charged at all times by means of this direct-drive, wind-driven battery charger. Those living where a.c. or d.c. current is not available can now operate 6-volt all-electric receivers without making frequent trips to town for re-

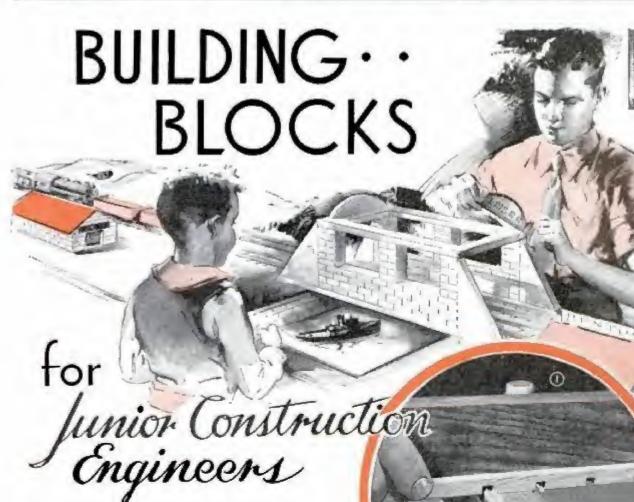


Wind Charger with Batteries Connected

charging. Available in two sizes, the large model shown in the illustration can be used also to provide a small home lighting plant which will carry from four to six 6-volt 30-watt lamps.

(Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; when material lists are not included in the articles, these are available without charge on receipt of postage.

AMATEUR



You'll find it enjoyable to watch a model skyscraper go up, floor after floor; to build a scale model of the local post office for a mantel decoration, or to make a realistic depot, bridge and other buildings as an addition to the electric railroad received at Christmas. All of this is possible with miniature building blocks made in a few hours' time.

Ordinary patching plaster was found satisfactory for casting the blocks; it will not set too quickly nor too slowly, it can be colored and otherwise treated and does not shrink. The latter is important when models are to be made to scale. Now, to make some bricks and blocks we need a form that will turn out at least a hundred blocks at a time. A satisfactory form is a



Notched Strips of Hardwood Assembled to Form a Grille in











grille made from oiled strips of wood. The spaces should be an inch long, % in. wide and % in. deep. To be sure that the strips will mesh accurately, use the jig for a circular saw with dado head, as shown in Fig. 1. A board screwed to the miter gauge has a small pin fixed to act as a guide in advancing the strips each time they are passed over the cutters.

The water with which the patching plaster is mixed is first tinted with water color so that all of the blocks will be of a uniform brown or sand color. When blocks of marble are to be imitated a little water glass may be added, and a trace of black color stirred in just before the forms are to be filled. A common putty knife is convenient for filling the forms, as shown in Fig. 2. The material will set in about an hour. Then, instead of trying to punch the blocks out of the grille, take it apart strip by strip as shown in Fig. 3. Clean the strips before assembling them for casting another batch.

The model buildings are best built up on a thick wood base on which has been poured, in a wood form, a narrow foundation as in Fig. 5. To securely anchor the foundation, place small brads part way into the wood base before the plaster is poured. An ordinary plaster and water

cement is not satisfactory for "laying" the bricks or blocks, but if
patching plaster and ordinary black
enamel are mixed to the consistency of a salve, an excellent cement
is produced. With a small putty
knife, coat two sides of each brick
with cement and carefully lay it in
place as shown in Fig. 6. A straightedge may be used to keep the
bricks properly lined up. After a

few bricks have been laid, take the broad end of a toothpick and clean out the excess cement from between. When bricks of odd lengths are required, use a hand coping saw, which is better than cutting them with a knife. Your first project should be something simple, such as the "country jail" shown in Fig. 4. The door is of blackened thin veneer. The window bars are match sticks given a grayish-black color with liquid shoe polish.

Now we come to another type of construction; the reproduction of old buildings built of stones, of which the crumbling castle shown in Fig. 7 is an example. Patching plaster was first mixed with white enamel to the consistency of a thick dough, and when well kneaded, a trace of black enamel was worked in. A small piece of the material was placed in the palm of the hand and rolled into a ball, then set in place on a wood base without the use of cement. If care is taken to make the dough quite thick it is possible to cut the imitation stones in half with a knife, placing the flat surfaces to the front. This material should be left to dry over night, after which it will hold together quite as well as if it were cemented. The model engineer will learn quickly that it is easy to build realistic models of any building with this material. Also, he will learn that it is possible to give bricks a glazed effect with a coating of water glass, (sodium silicate) and to mix small quantities of ground mica with the patching plaster to make blocks that will shine with pin points of light when properly illuminated.

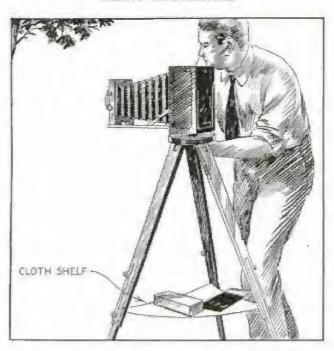
Fluid to Prevent Work Slipping on Lathe Faceplate



When making faceplate turnings, which are held only by the center screw, a photographer applies retouching fluid to the faceplate so that the turnings will not slip. As this fluid has a

rosin base, a satisfactory substitute may be made by dissolving ordinary lump rosin in turpentine. One coat lasts for some time.

Cloth Shelf in Tripod Holds Photo Accessories



Cloth Shelf Suspended between Tripod Legs Holds Extra Plates, Gloves, Focusing Cloth, Etc.

A cloth shelf, that spreads or folds within the tripod, will be found very convenient for outdoor photographers to hold
extra plate holders, focusing cloth, gloves,
etc., and keep them readily at hand. The
cloth may be provided with metal rings
which are snapped over screw hooks inside the tripod legs. This makes it possible to detach the shelf when not in use.

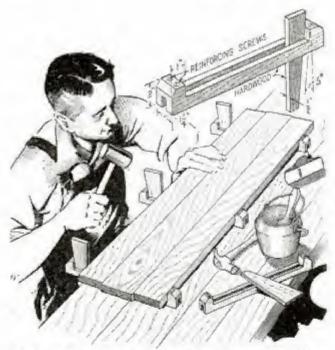
Mallet Has Replaceable Faces

After a wood mallet has been used for a short time, the faces often become so dented that it is useless for anything but rough work. To avoid this, it is more sat-

isfactory to turn a mallet from hickory and fit it with replaceable faces. The mallet shown has a hickory insert on one end, and several layers of rubber on the



other. While turning it on the lathe, make a shallow hole 1/8 in. deep in one end, and a hole 1/2 in. deep in the other end, and then turn a number of the face pieces for future use. The rubber faces are built up of disks cut from inner tubes, and are held in place with rubber cement.



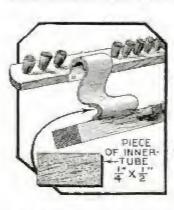
Made of Scrap Stock, These Bar Clamps Will Draw Up a Joint Tightly

You Can Make These Inexpensive Bar Clamps

These simple bar clamps can be made of scrap material found around the shop. They may be made any convenient length as wood wedges can be inserted between the tailpiece and the work to take up surplus length. The slot through which the wedge extends is cut on a circular saw, and runs only to the headpiece. The wedge has a 5° slant. After blocking the work in place, a few hammer blows on the wedge will draw up a joint tightly. A set of four clamps of uniform length is suggested.

Repairing Worn Brushes on Your Vacuum Sweeper

If the bristles of the brush on your vacuum cleaner have worn down so that they



do not touch the carpet, and there is no adjustment provided for lowering the brush, it can be made to work effectively by lowering it with pieces of rubber cemented to the spring clamp as shown. Rubber

for this purpose may be cut from an old inner tube, using one or more thicknesses. —C. M. Boyce, Schenectady, N. Y.

Rubber Bands Make Safe Handle for Glass Scraper

Using small squares of window glass for scraping and smoothing woodwork saves

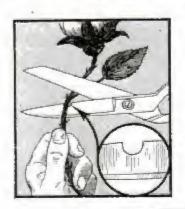
much of the time and labor usually spent in rough sanding, but your hands or fingers may be injured on the sharp edges of the glass. As protection against such accident, cut a couple of bands and a rectangular



piece of rubber from a discarded inner tube and fit these over the glass square to provide a safe and comfortable hand grip.

Scissors Notched to Cut Flower Stems

Have you ever tried to cut rose stems with an old pair of scissors and found that the stem just slid along between the blades? This difficulty is caused by the



scissors being dull and can be remedied by filing or grinding a notch in one of the blades which will hold the stem while the other blade is cutting it off.—W. Barnes, Midland, Tex.

Keeping Ants Off Table with Grease Barrier

Here is a method used successfully by a camping party to keep ants off tables and cupboards. A large rubber disk and

two or three smaller ones were placed under each table leg, after which the large disk was coated liberally with cup grease, the small



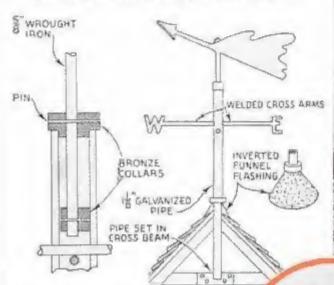
disks being placed on top to keep the leg from coming in contact with the grease. The disks may be cut from an old inner tube, oilcloth or other material.

WHITHER BLOWS THE WIND?

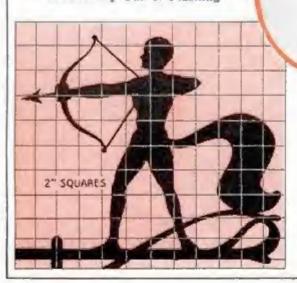
The Iron Weathervane, Like Its Contemporary, the Brass Knocker, is Returning to Popularity, and an Attractive Design is Within the Means of the Average Family, as it Can be Made Mostly at Home



Black Sheet Iron Is Generally Used for Making Weathervane Silhouettes although Other Materials, Such as Duralumin and Brass, Painted Black When Finished, Are Also Suitable; the Thickness Depends on the Size of the Figure, 1/16 In. Being the Minimum; Action, with a Touch of Caricuture, Has a Universal Appeal



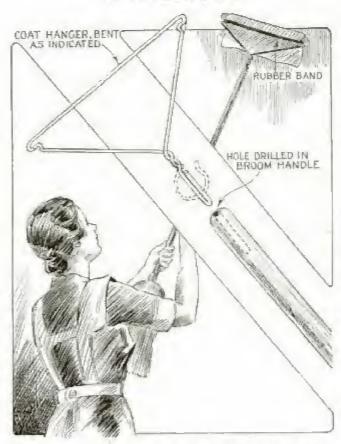
Details Showing Method of Mounting; Two Cross Arms, Indicating East and West, May Be Attached to the Support; Roof Leaks Are Avoided by Use of Flashing





Here Are Two Lively Silhouettes That You Can Enlarge on a Sheet of Paper and Transfer to the Metal; Hobbies as Well as Professions Can Be Represented

Wire Coat Hanger Converts Broom into Wall Duster

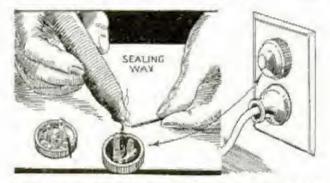


Wire Coat Hanger in End of Broom Handle Holds Dust Coth for Wiping High Walls and Ceilings

To simplify the task of wiping high walls and ceilings with a dust cloth, one housekeeper uses a wire coat hanger, which she inserts into a hole drilled in the end of her broom handle. The hanger is bent as indicated, and the dust cloth is held in place with a heavy rubber band.

Protecting Children against Electrical Shocks from Wall Outlets

The impulse of a small child to stick things into any hole it may find, has resulted in many children receiving severe electrical shocks by sticking pins, forks,

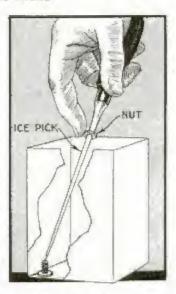


Attachment Plugs Filled with Wax Protect Child against Electrical Shocks from Wall Outlets

and other metal pieces into exposed wall outlets. This danger to your child can be avoided by filling some extra attachment plugs with sealing wax and keeping them in the unused outlets. Round plugs are best for this purpose as they are more difficult for a baby to pull out than other types. As an additional safety factor, bend the plug points together slightly so that they make a tight fit in the outlets.—Philip A. Eyrick, Arlington, Mass.

Ice Pick Aids in Starting Small Nuts

The next time you have a small nut to start on a bolt, which is located where it is difficult to reach with the hand, try using an ice pick, as shown, to get the nut on the threaded end of the bolt. This idea is handy where the head end of the bolt can be reached to turn it



with a wrench or screwdriver, although it may take a little patience to get the nut started straight on the threads.—John Modroch, Chicago.

Screw Eyes Hold Oar Blades Vertically

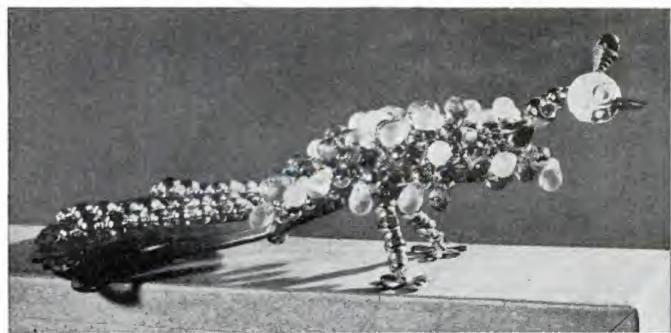
In rowing with oars in open locks, many amateurs find it difficult to hold the oar blades in a vertical position. To overcome

this, one resort manager drove a pair of screw eyes into each oar as shown, so that they would engage the forks of the locks, and prevent the oar blades from turning.



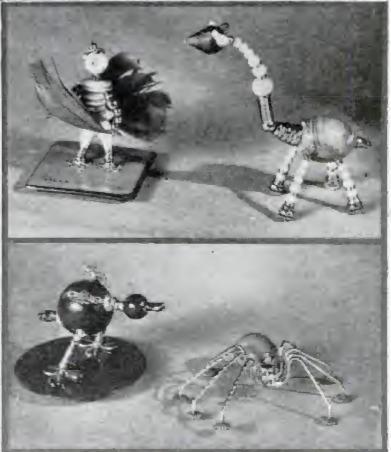
To write black on glass or bright metal, use a mixture of water glass, 1 to 2 parts, and liquid India ink, 10 parts; clean the surface and use a steel pen.

Novelties Made from Beads and Old Jewelry



Gold and colored glass beads, from necklaces, bits of discarded jewelry and other suitable material found around the average home, can be made into attractive novelties for mantels and tables. Besides the figures shown, many other novel designs will suggest themselves as you progress with the work, the beauty of which depends largely on the care and thought exercised in the selection of contrasting colors, and the judicious use of sparkling stones. In forming the various figures, brass or gold-plated wire is used for stringing the beads and for most of the body members; it is soldered, twisted or tied together, whichever method is most suitable. One of the most ornate of all the figures is the peacock shown above. The broad, graceful tail, as well as the foundation for the back, is an old-fashioned back comb, which is ornamented

with strings of colored beads, the colors being blended to get a beautiful effect and the body covered with colored-glass "teardrops." The neck, which terminates in a stone head surmounted by a "topknot," is a stiff piece of gold wire covered with beads. The legs are of similar material and the feet consist of rosettes taken from tencent store jewelry. The other figures are



made in a somewhat similar manner. The bodies of the giraffe, spider and duck are large beads or stones fitted with legs of bead-covered wire ending in suitable feet, an exception being the spider's legs, which are plain gold wire.

([Ventilation is necessary for stored potatoes to keep them in good condition.

Using an Expanding Drill in a Lathe



Turned Boxes, Vases and Similar Articles Hollowed Out with Expanding Drill Held in a Lathe

When turning vases and similar articles on a lathe, considerable skill is required to hollow out the interior with a chisel. Also, it is difficult to do the job beforehand with an expanding drill, as the hole is not likely to be straight. A better method is to round off the corners of the squared end of the drill shank so that it can be used in a chuck in the tailstock of the lathe. If the latter has a very slow speed adjustment, the hole can be drilled with the power on; otherwise the lathe should be turned by hand. Filing the end of the drill will not prevent it from being used in a brace chuck.

Excelsior Assures Drainage of Potted Plants

An experienced gardener claims that potted flowers make better growth if the

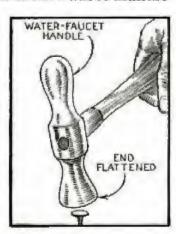


earth is not allowed to pack solidly over the drain
opening in the
bottom of the pot.
To prevent this,
he places a wad of
excelsior in the
bottom of the pot
directly over the
opening, before
the pot is filled

with dirt, to assure proper drainage and keep the soil sweet. Other methods recommended are to use steel wool, gravel or a curved piece of metal, or even a piece of the curved side of a broken flower pot.

Tack Hammer Made from Faucet Handle

If you have any old water faucets lying around, their handles can be made into tack hammers very easily by fitting them with suitable handles. Flatten one end of the faucet handle with a file or grinding wheel, and, if nec-



essary, ream the screw hole a little to take the handle.—Fred Cornelius, El Paso, Tex.

Canvas Sheath on Tent Pole Holds Loaded Gun Safely

The problem of safely storing your gun in camp is solved by tacking a canvas sheath to one of the tent poles as shown. This keeps your loaded gun out of the way where it is not likely to be discharged accidentally, yet it is readily available any time it may be needed.



Tacked to a Tent Pole, a Canvas Sheath Keeps Your Gun Safe, Yet Easily Accessible

(When you are in need of shoe polish, and none is at hand, try a little paste floor wax; this has a neutral color and may be used on either dark or light shoes.

Perforated Disk Speeds Filtering of Liquids through Cotton



When filtering liquids through a funnel partly filled with cotton, you will find that the work can be done much faster if a perforated cardboard disk is placed in the bottom of the funnel to keep the cotton

from packing in the mouth of the spout. After perforating the disk, dip it in hot paraffin to make it waterproof.

Sanding Sleeves for Small Hand Grinder Made Quickly

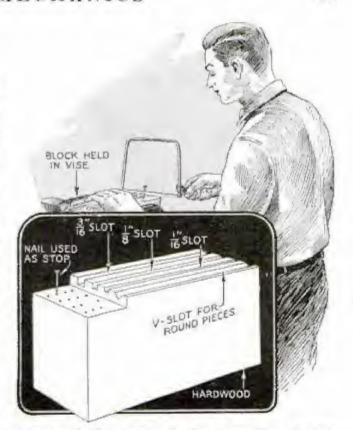
If you have a small hand grinder, it may be converted quickly into a high-speed sander for intricate work. Select a grinding wheel of the desired shape and wrap it tightly with gummed paper. Wrap the paper with the gummed side out, overlapping



Abrasive Wheels Wrapped with Sandpaper Convert Small Hand Grinder into Sander for Intricate Work

the ends slightly and sticking them together. Then moisten the gummed surface and apply a strip of abrasive paper, first beveling the ends to make a neat joint. The gum will dry quickly so that the sander may be used immediately. When the job is finished, the paper can be removed from the wheel without damaging it in any way.

(Smoke from soft coal will cause varnished furniture to look cloudy.



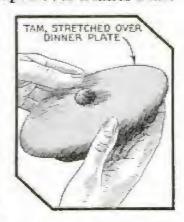
Block with Slots in Top Surface Saves Time in Cutting and Sanding Small Parts for Models

Combination Sanding Block Aids Model Makers

Made of hardwood, this combination sanding and cut-off block will aid when making small wood parts for models. Slots of various sizes in the top surface hold the parts to be cut off, or to be sanded, while a step at one end has a series of holes in line with each slot, in which a nail is used as a stop. The saw is guided by the face of the step. Long pieces are sanded by placing them in the grooves where friction holds them firmly to prevent slipping.

Laundered Tam Shaped over Dinner Plate

After laundering a knitted wool
or silk tam, stretch
it over a dinner
plate and lay it on
a clean paper to
dry. If the plate is
of the proper size,
the tam will hold
its shape, and further stretching or
pressing will be



unnecessary. As the tam will shape itself to the exact size of the plate, one with a smooth edge should be used. Interchangeable POWER



THE amateur skipper who would like a number of model boats, but cannot afford a power plant for each hull, will find the solution to his problem in this interchangeable steam unit. It consists of a twin-cylinder engine and a boiler, which is fired by a blowtorch. The unit will han-

dle any model from a speed boat to a stern-wheeler, and it can be switched from one hull to another in a few moments. In addition to boats, the unit may be used to operate model cars, tractors, derricks, steam shovels, etc.

The first thing needed is the engine, which can be purchased from several sources. It is best to get a boiler at the same time, although one may be made from large, brass pipe. If this is done, a safety valve and water plug should be installed as well as a water and a steam-pressure gauge.

Two lengths of tin or aluminum angles, cross-braced at the ends and center, form the base of the unit. The blowtorch burner and boiler are fastened to the base with brass strips, while the engine is screwed to it. It probably will be necessary to tilt the engine slightly so that its crank shaft

PLANT for Model Boats

alines with the propeller shaft. After assembling the unit compactly on the base, the hulls are made ready to accommodate it. Figs. 1 and 2 show how this is done for boats that are driven by screw propellers, while the arrangement for a stern-wheeler is shown in Fig. 3. After placing the hull in water, the unit is shifted fore and aft until the boat trims. Then, the position is marked and a spring clip and pegs are put in the bottom of the hull to hold the base in position as shown in Fig. 2.

Next comes the propeller assembly, which is mounted so that the shaft terminates just behind the engine eccentric. Metal disks, keyed to the engine crank shaft and to the end of the propeller shaft, form a universal coupling, steel pins engaging slots in each disk as shown in Fig. 1. The engine is connected to the propeller by guiding the pins into the slots as the unit is slipped into the hull. To get maximum speed from a model, it is important that all parts turn freely, which makes it necessary that the propeller and engine be in perfect alinement. To mount the propeller assembly, cut a slot in the center of the hull where the shaft and its housing are to pass. Then bolt the bear-





ings in place, being sure that the propeller shaft lines up with the engine shaft. Pack the space between the propeller housing and the bottom of the boat with plastic wood to assure a water-tight job. This completes the work with the exception of a rudder, which can be made from brass and fastened to the stern of the boat as shown in Fig. 2, using a fret-saw blade with the teeth turned up as a quadrant.

For stern-wheelers, mounting of the unit is done in a similar manner. However, in this case the driving mechanism consists of reduction pulleys and small coil springs, which are used as belts. This hookup is shown in Fig. 3. Sizes and speeds of the pulleys are not given as these depend largely on the type of paddle wheel you use on your

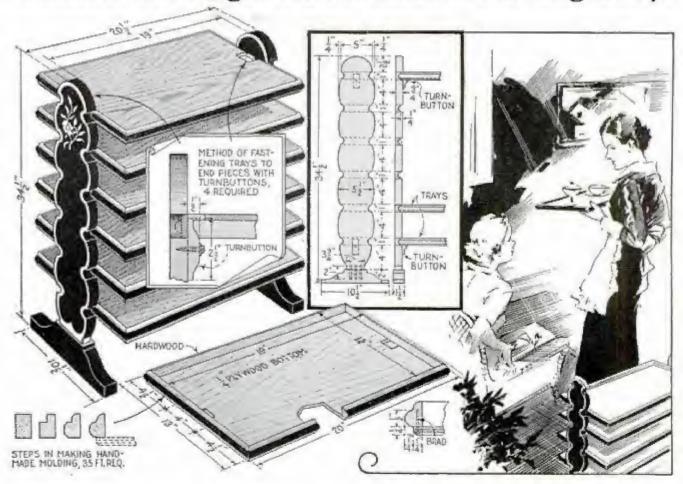
Colored Shellac Substituted for Enamel

Colored, white shellac will serve practically all the purposes for which enamel is used in coloring models, toys, etc. Shellac has the advantage of being less expensive and quicker drying than enamel, and it produces a durable, glossy finish that will stand rubbing down with pumice or rottenstone. In fact, shellac will stand almost anything that enamel will, except exposure to water. A dime's worth of each of the following colors in dry form will give you a good start: lamp black, burnt umber, burnt sienna, chrome green, chrome yellow, ultramarine blue, vermilion red and dry white lead.

In mixing the colors, pour into a container about the amount of shellac required for the job at hand, and then stir in the dry color, a bit at a time, until the desired intensity is obtained. By mixing, an almost limitless number of shades can be made. For instance, red added to blue, yellow or white produces purple, green or pink respectively, while yellow added to blue produces green, and black mixed with red produces brown. Pink added to yellow produces flesh, and black added to blue produces gray. By this mixing of colors, paints and enamels can be matched for repairing present objects, or for painting furniture, walls, etc., to match some you already have in your home.

 A good soldering flux may be made by melting tallow and rosin together, forming it into sticks when cool.

Combined Magazine Rack and Serving Trays



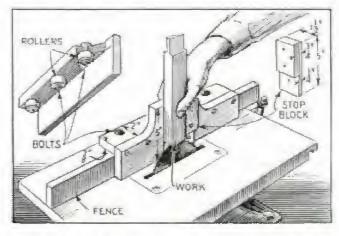
Serving the dual purpose of a magazine rack and serving trays, this unusual piece of furniture consists of six shelves, which are locked between two ornamental ends by means of four turnbuttons. Soft or hard wood may be used, but the moldings around the trays should be hardwood, as they take the strain of holding the stand rigidly. The shelf dadoes should be cut in

the end pieces before curving the edges as the work will be easier to hold, and any edge splintering will be removed with the waste stock. Care must be taken to drill the three dowel holes accurately in each foot and upright, otherwise the narrow foot boards may split when they are assembled with the uprights.—Edwin M. Love, East San Gabriel, Calif.

Sliding Jig Helps When Cutting Tenons on Circular Saw

To avoid any possibility of work turning in your hands when cutting tenons on the ends of long or narrow stock, use this jig, which slides between the fence and the saw blade to aid in holding the work rigidly. Three rollers, fitted as shown, bear against the rear face of the fence and guide the assembly, while a stop block, cut as shown in the right-hand detail and screwed to the front of the jig, aids in holding the work as it is pushed over the saw.

■Quicklime added to benzine, in the proportion of about 3 oz. to the gallon, will deodorize it; shake well and strain.



A Jig That Holds Work and Guides It over Saw to Cut Tenons on Long or Narrow Stock

Foot Clamp for Scroll-Sawing



Spring and Stirrup Enable You to Tighten or Release C-Clamp Quickly When Doing Scroll-Saw Work

To save time and eliminate the difficulty of tightening and loosening a C-clamp when doing scroll-saw work, attach a screen-door spring to the thumbscrew of the clamp and suspend a stirrup of heavy wire from the opposite end. In use, leave the screw of the clamp open and place your foot in the stirrup to hold or release the pressure on the work.

Easy Method of Drawing Spirals

Anyone who experiences difficulty in drawing neat spirals will profit by this method, which an experimenter in television used to scribe spirals on his scan-

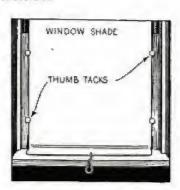


ning disks. A bolt or rod, having a diameter equal to approximately one-third the distance desired between the spirals, is tied to a fine wire, and a loop is provided at the

other end of the wire for a pencil or scriber. In use, the rod is set in the center of the work on which the spiral is to be made. Then, as the pencil is pulled around the rod, keeping the wire taut, the coils of the spiral will be spaced a distance equal to the circumference of the rod, provided the wire is not allowed to overlap as it winds on the rod. If the spiral spacings are critical, the exact diameter of the rod to be used can be found by dividing the desired distance between the spirals by 3.1416.

Thumb Tacks Keep Shade Close to Window

When a shade warps or bulges so that it will not lay close to a window, a few thumb tacks pushed into the inner edges of the sash will serve as guides to keep the shade in place.

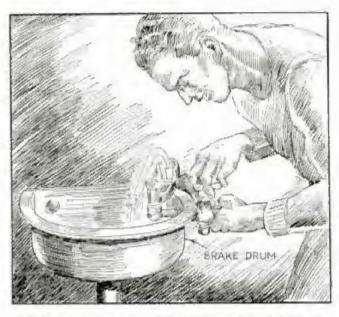


If the tacks are of the same color as the sash, they will not be noticed, and the edges of the shade are easily inserted under the tack heads when it is pulled down.

—C. E. Edson, Cleveland, Ohio.

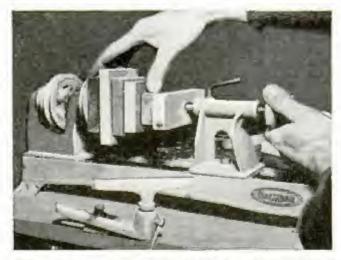
Brake Drum Used as Bowl of Fountain

A drinking fountain in the athletic field at the Costa Mesa, Calif., junior high school is built around a truck brake drum. Part of the drum is cut away and a flat plate is welded to it as shown. The drum is bolted to the side of a building, or it may be mounted on a standard, which then serves as a drain for waste water.



Old Car Brake Drum Mounted on Pipe Standard Serves as Bowl of Drinking Fountain





When a Clamp Is Not Available for Holding Glued Stock, Try Clamping It between Lathe Centers

Lathe Used as a Gluing Clamp

When you have a number of pieces to glue together, and no clamp is available, your lathe may be used as a substitute. Glue the pieces and place them between the lathe centers, using a small faceplate on the headstock, and adjusting the tailstock to apply pressure. An extra block of wood should be used in front of the dead center to prevent the point from marring the work.

Movable Safelight for Your Darkroom

Where an overhead safelight is used in a small darkroom, the pulley arrangement shown will be found useful as it permits the light to be shifted to any position above the workbench or sink without the cord becoming entangled with bottles, trays, etc. The lamp is provided with a long, flexible cord, and two pulleys are screwed to the wall or ceiling above the bench. The cord is run through a counterweighted

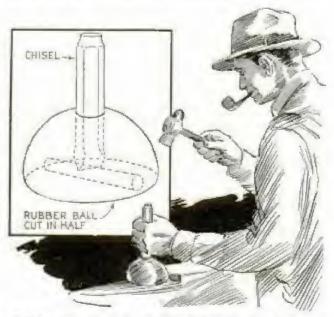


Darkroom Safelight Suspended between Pulleys above Workbench Is Moved Easily to Any Position

pulley and then over one of the pulleys on the wall. A small rope, with a weight at one end, is run over the other pulley and tied to the cord near the lamp as shown.— Paulmer Beck, Los Angeles, Calif.

Half of Hollow Rubber Ball Aids in Cutting Nails with Chisel

Have you ever tried to cut off a short piece from a nail, pin or a length of wire with a cold chisel and lost the piece when it flew off? One half of a hollow rubber ball, slipped over the chisel as shown, will



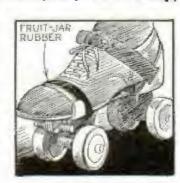
Rubber Guard on Cold Chisel Retains Short Pieces Cut from Nails, Wire and Pins

prevent this trouble. It is a good idea to make the hole in the rubber a loose fit on the chisel so that it can be raised to set the tool on the work.

Fruit-Jar Ring Serves as Emergency Skate Strap

When your skates have a tendency to slip off your shoes, a fruit-jar rubber will serve nicely as an emergency skate strap,

especially if your shoe soles are thin and flex under the strain of the skate clamps. The rubber is slipped over the skate and the toe of the shoe as shown in the illustration.





to contain fish has interesting possibilities for the submarine observer. A glass-bottom boat for this purpose provides the means of a profitable and pleasant summer occupation. The design shown is a simplified adaptation of the well known glass-bottom boats of Catalina island. Of course, the bottom is really wood with the exception of an observation window of comparatively small area. As this window is set in a well, the boat does not fill even if the glass should be broken. But it is necessary to use the window because

it at bow and stern. When the two sides

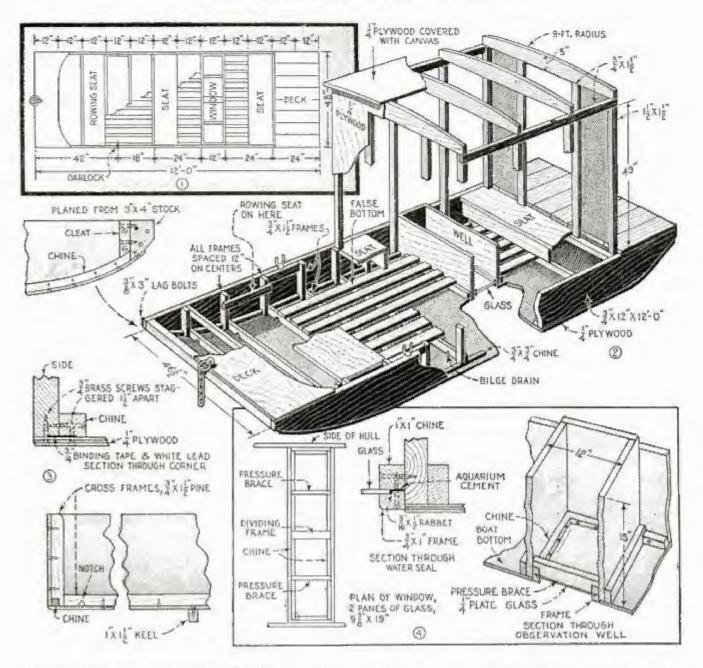
are completed, join them with the cross-

members at the ends. These are cut from 3 by 4-in. stock and planed to shape.

Apply white lead on the ends and fasten

the sides to them with lag screws. Now

turn the assembly upside down, and over

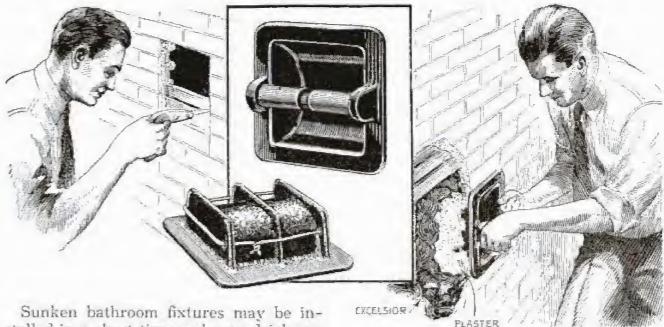


the joint between chine and side member lay a 34-in, strip of binding tape soaked with white lead. Lay the plywood over this, fasten temporarily with finishing nails, and then permanently with 34-in. brass screws, staggered as indicated in Fig. 3. This detail also shows the manner of screwing the cross frames in place. After all the cross frames have been installed, build the well and window between the fifth and sixth frames as illustrated in Fig. 4. Note that a 1 by 1-in. chine is fitted near the bottom of the well, and fastened with 11/2-in, galvanized screws. The glass is clamped against this by means of a rabbeted frame, the joint being filled with aquarium cement before screwing down. The window is made up of two panes of 1/4-in. plate glass, and besides the dividing frame between them, there are two pressure braces on the top side. Seats are installed on each side of the well, making a capacity of six children or four adults. A false bottom is laid, as shown, and the cabin built up on a light framework. It can be covered with ¼-in. plywood or simply with canvas. Two doorways are provided, and a sliding curtain hung over them to shut out the light. The oarsman can shove his feet under the forward passenger seat, if he needs room.

While this craft is only 12 ft. long, in order to use a single panel of standard-size plywood, a longer hull can be made by using separate pieces for the bottom on either side of the well.

¶Old phonograph needles make excellent glaziers' points; drive them into the sash in the usual way, before putty is applied.

How to Install Sunken Bathroom Fixtures



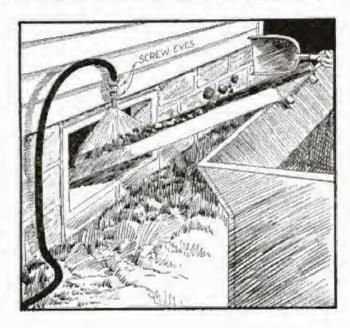
stalled in a short time and a good job can be done without marring the wall if you proceed carefully. First measure the back of the fixture and mark this off on the wall. Drill a hole at each corner and saw along the penciled line with a keyhole saw. Do not use a chisel as this may cause such large chips to break off the edge of the hole that the broken portion cannot be covered by the fixture. The next step is to run a piece of wire through holes in the ribs and around them as shown in one of the details. This is to help in anchoring the fixture in patching plaster. Now take enough excelsior to form a "nest" in the wall to hold plaster so that it will not drop

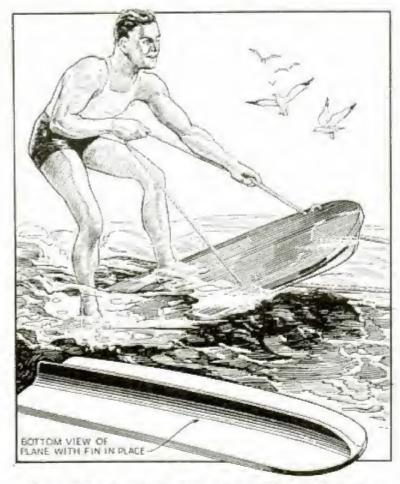
down inside of the wall. Pack the excelsior tightly at the bottom and on both sides. After the nest has been made, apply the plaster or a rich mixture of cement to the excelsior so that the fixture, when pressed into place, will bury its ribs deeply into the plaster-covered excelsior. Also smear some plaster over the back of the fixture, getting it well into all corners and under the anchor wire so that this plaster will unite with that packed on the excelsior. Then press the fixture firmly in place and, with a moist cloth, wipe off the excess plaster that has been squeezed out. Allow the plaster to set overnight.

Hose Attached to House Wets Coal as It Enters Basement

Instead of flooding his lawn by spraying each load of coal with water before it was unloaded into the cellar, a home owner drove a couple of large screw eyes into the side of the house just above the coal window. By slipping the nozzle of the garden hose into these and adjusting it for a fine spray, each shovelful of coal was dampened as it passed down the chute.

(It has been found by experiment that lime flour, if sprinkled in liberal quantities on a freshly tarred roof, will do much toward lengthening the life of the latter; the lime causes the tar to set somewhat like concrete and also prevents defects in the coating caused by the weather.





Tapered Hardwood Fin Screwed to Bottom of Aquaplane Makes It Easy to Handle

Fin Makes Aquaplane Easy to Handle

If you have difficulty in riding an aquaplane, fit a fin on the bottom as shown, which makes it easier to handle. A length of 2 by 6-in, hardwood is used for the fin, which is rounded at the nose, and tapered from a full 2 in, at the top edge to about 1/4 in, at the bottom edge. It is best to attach the fin with brass screws, the heads of which should be countersunk and the holes filled with putty. Care must be taken to get the fin exactly in the center and parallel with the edges of the aquaplane.

Jig for Spacing Punch Marks

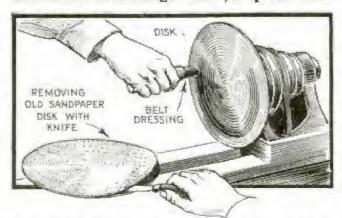


When it is necessary to make a series of uniformly spaced punch marks on metal, this simple wire jig will enable you to do the work more accurately and in less time than it would take to measure each space. As shown, the jig consists of a coil of wire wrapped around the punch so that it terminates in a pointed hook, which is bent at right angles at the end. The desired spacing of the marks determines the length of the projecting end of the wire. In use, the hook is held in each preceding punch mark as the following one is made.—F. L. Yerzley, Ithaca, N. Y.

Sandpaper Disks Quickly Renewed

Sandpaper can be fastened to a metal sanding disk and used almost immediately if it is cemented with stick belt dressing, which comes in cardboard tubes. The worn paper is removed by inserting a knife blade under it as shown, after which the disk is mounted in a lathe and rotated at high speed, meanwhile pressing a stick of soft wood rather firmly against the disk to heat it. After

it is thoroughly warmed, the belt dressing is substituted for the stick and the pastelike substance well distributed over the surface by working repeatedly from the center out to the edge. Now, stop the lathe

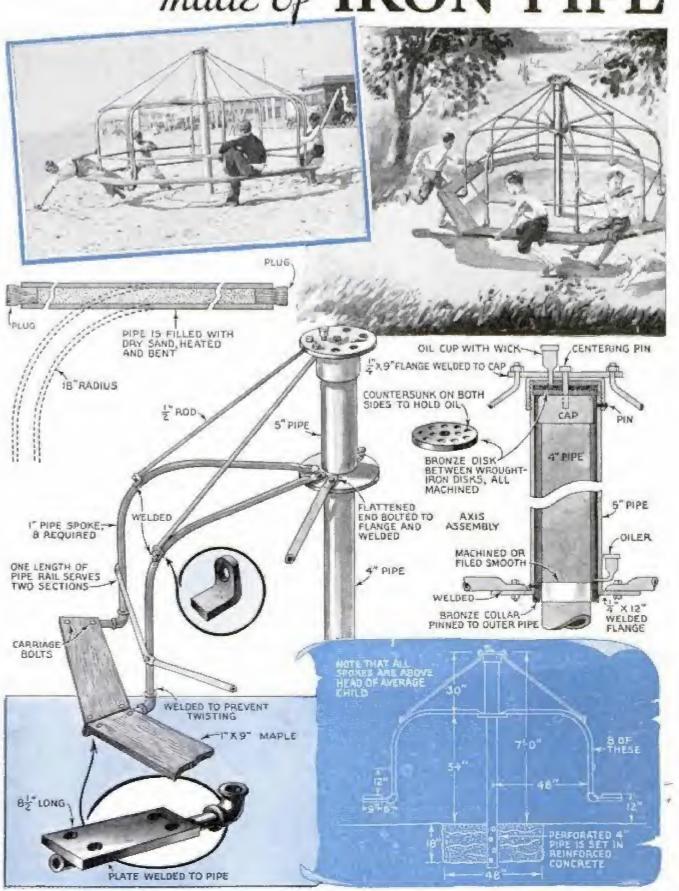


New Abrasive Paper Applied to Sanding Disks by Using Stick Belt Dressing as a Cement

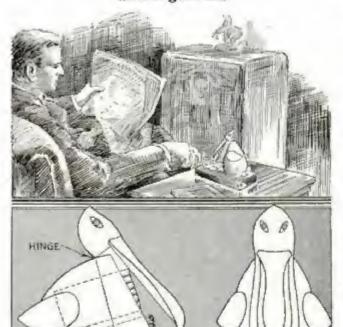
and apply the sandpaper disk while the dressing is soft and sticky. Rotating the lathe a few minutes at low speed to cool the disk completes the operation.

(Bright colored glass marbles placed in crevices among the rocks add color and brightness to the rock garden.

Merry-Go-Round made of IRON PIPE



Pelican Ash Tray Holds Matches and Cigarettes



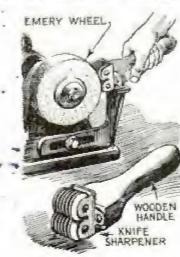
Opening the Pelican's Beak on This Ash Tray Exposes a Cigarette and Match Compartment

ASH TRAY

Resembling a pelican, this novel ash tray has a match and cigarette compartment which is exposed by tipping the bird's hinged head to open its beak. The bird is carved from any suitable soft wood, and it is screwed to a base, which is recessed to take a small ash tray.—Emory Morris, Jr., Atlanta, Ga.

Grinding Wheel Dressed with Disk Type Knife Sharpener

A satisfactory tool for dressing emery wheels can be made by mounting a disk-

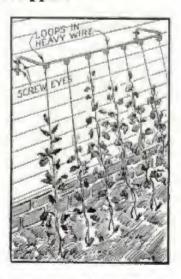


type knife sharpener on a suitable
handle. It is best
to get a sharpener
that has an open
top, although the
closed type may
be used by cutting
away the housing
with a file and
hack saw. To dress
a wheel, move the
sharpener back
and forth against

it as it rotates, resting the handle on the tool support. It is always advisable to wear goggles when doing this work to keep flying particles of emery out of the eyes.

Looped Wire Makes Removable Trellis Support

A string trellis attached to the side of the house with tacks or nails is not only difficult to remove for repairs, but it also brings the growth of vines against the siding to retain moisture and damage the paint. To avoid this, and at the same time provide a trellis



support which will be neat and practical, bend a heavy wire as indicated and drive screw eyes into the siding to receive it.

Large Pulley on Lathe Converted into Handwheel

If you are not in the habit of using the large pulley on your woodturning lathe, it can be converted into a handwheel for stopping the lathe quickly or for turning the headstock when indexing, etc. To do this, turn a wood disk to the same diameter as the pulley, or slightly larger, and

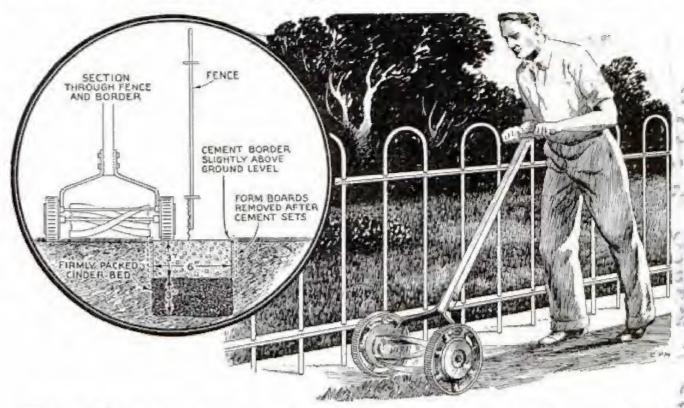


then saw out the center to produce a ring which will fit the pulley snugly, beveling the inner edges of the ring to fit in the V-groove of the pulley. Now cut the ring in half, and drill

the ends for dowels. Then fit the ring in place, using glue on the dowels. Sanding the ring and giving it several coats of shellac finishes the job.

To clean plaster ornaments such as busts, vases, etc., dip them in a solution of starch and water, let it dry and then brush it off.

Cement Border Simplifies Mowing of Lawn



Time and labor required to trim a lawn along a fence where the grass cannot be cut with a lawn mower will be saved if the fence is set on a strip of cement. This will keep the grass from growing next to the fence, and the posts can be set in the cement for longer life. For best results, the border should be about 6 in. wide and 3 in. deep, and it should set on a 3-in. cinder bed.—L. N. Olsen, Philadelphia, Pa.

Powdered Kitchen Substances Dispensed from Fruit Jars,

Here is a handy arrangement for dispensing powdered and granular substances in your pantry or kitchen cabinet. It consists simply of a number of fruit jars mounted upside down on a shelf or rack, which may be set on a table, placed on your cabinet or hung on a wall. A hole in the center of each jar lid is provided with a pivoted tin cover, cut as shown, for measuring out the contents of the jars.

Aluminum Paint Protects Metal

Actual tests have proved that aluminum paint makes an ideal covering for metal exposed to the weather. By giving the metal a coat of lead and then an application of aluminum paint, the work is not only covered well and fully protected, but it is made quite attractive.



Fruit Jars Mounted in Racks Serve as Handy Dispensers for Salt, Sugar, Flour, Etc.

Black Light Reveals



Unusual Miniature Stage Displays Obtained by Using Paints That Fluoresce under Black Light; the Dancing Skeletan with Pivoted Arms and Legs Is Operated with a Thread

CECRET messages written with colorless ink on ordinary white paper, stand out legibly as if luminescent ink had been used, when they are held under the dim blue glow of a black-light bulb. Removing the paper from the bulb again causes the writing to fade out so that you can see nothing but a piece of blank paper. The colorless ink used for this purpose is made by dissolving the contents of two 5-grain capsules of ordinary quinine sulphate in a ½-oz, mixture consisting of water 2 parts. and rubbing alcohol 1 part. When this solution is used instead of ink, with a clean pen, it dries quickly without leaving the slightest trace of writing. Lemon juice in water, aspirin tablets dissolved in water

450 Cencernote Chio

estinghouse Lamp 6

Secrets and Mystifies



Invisible Inks, Made by Dissolving Quinine in Solution of Water and Alcohol, Lemon Juice or Aspirin Tablets in Water, Stand Out as if Luminescent Ink Had Been Used, When Viewed under the Dim Blue Glow of a Black-Light Bulb

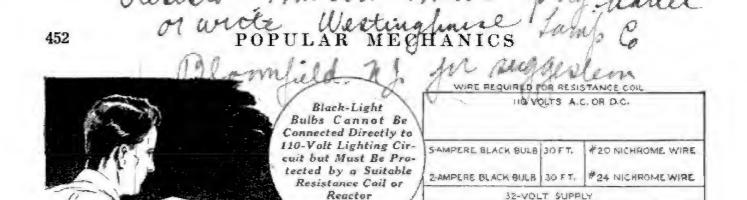
and many other common substances may also be used as secret inks, which are invisible except when viewed in a dark room under the ultra-violet light of the black bulb. It has been found by the Scientific Crime Detection laboratory that all known secret inks can be read easily under ultra-violet rays. This fact makes the examination of documents and letters, which are suspected of containing secret messages, very simple. Even secret inks that are usually heated or treated with chemicals, show up clearly under black light without any other treatment.

An amusing application of the use of invisible ink for the purpose of entertainment at parties, is a fortune-telling stunt in which each guest picks up an apparently blank sheet of paper and takes it into the dark room of the fortune teller, who, after suitable incantations, slowly brings the paper under the range of a black-light bulb. As if by magic, the fortune, previzing

ously written on the blank sheets with invisible ink, will appear legibly. After the message has been read, the performer folds the paper while it is still under the light, and gives it to the guest to keep. Of course, the message will be invisible when re-examined under ordinary light, which adds greatly to the perplexity of the guest.

Although there are many ultra-violet lights available, the black-light bulbs, which are made from dark-blue glass, are the best for most purposes. These bulbs are also effective as health lamps and will produce sunburn in about 25 min, when the lamp is at a distance of 18 in. from the untanned skin.

Anyone can rig up a black light to work on 110-volt current, either alternating or direct, with which these and hundreds of other interesting and useful experiments may be performed. Any kind of a floor or table lamp having a reflector may be used provided it is connected with a resistance



5-AMPERS BLACK BULB

2-AMPERE BLACK BULB

RESISTANCE

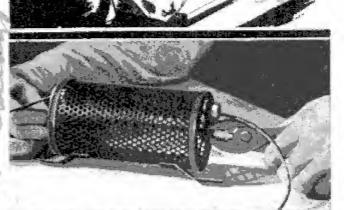
DIAGRAM OF CONNECTIONS

STANDARD SOCKET BLACK BULB -

SFT. 1IN. #20 NICHROME

SET.LIN

WIRE #24 NICHROME



coil. The correct amount of Nichrome wire used in making resistors for this purpose is given in the chart. Black-light bulbs must not be connected directly to the 110-volt light line because they will burn out almost instantly. Therefore, they must be protected either by means of a suitable resistance coil or the more expensive reactor. The resistance coil will get hot when the bulb is being used and should therefore be rigidly mounted in a perforated metal housing, as shown in the illustration, to avoid fire hazard.

Many chemicals that ordinarily do not phospheresce at all, glow brilliantly and in unexpected colors when placed under black light. A dilute solution of the dye "Fluorescein," which is clear and almost transparent under ordinary light, becomes opaque green. Some varieties of red ink appear canary yellow and mercurochrome solution glows with an equally unexpected color change. Many minerals, chemicals and crystals fluoresce in colors under black light, Calomel, uranium nitrate, anthracene, moth balls, and many oils and minerals glow brilliantly with characteristic colors. Paints, which change color and glow with a fiery brilliance under black

light, are made by mixing powdered chemicals or minerals which fluoresce with clear shellac, lacquer or gum solutions. Better results are had by buying ultraviolet paints ready prepared. These are available in a large variety of colors and with them designs may be painted such as those used in decorating the scenery for the model stage shown in the illustrations. These model stage fittings present an entirely different appearance in ordinary light and in black light. The paper skeleton may be made to dance and jump by pulling strings from which it is suspended. Under ordinary light it is simply a likeness to a skeleton with the black lines shown in the photograph, but when the black light is turned on only the painted portions appear, thus presenting a likeness to a real skeleton in which each bone is visible by the glowing light it emits. Various colors of ultra-violet paint are used to make the show realistic. The stage itself is also decorated with designs and colors, both of which change under black light. In all experiments with ultra-violet the room should be darkened in order to produce the best effect.

Although the ordinary glass in camera lenses will not transmit all of the ultraviolet light, it is possible to produce very unusual photographs by illuminating the object with black light. Any common object may be photographed first with ordinary light and then with black light only. Of course, time exposures will be neces-



Black light may also be used to detect counterfeit bills. The unprinted sections of paper in good

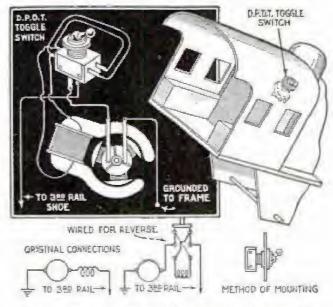
bills fluoresce with a bluish white color, while almost all counterfeit bills appear yellowish brown under black light. Various grades of paper show characteristic colors when viewed under black light and when all but one page of a document show

the same color, that page may be suspected as being a forgery. Altered writing may also be detected under ultra-violet light due to the fact that a different ink is invariably used in making the alteration, and the difference is easily discernible.

Radio Toggle Switch Used to Reverse Model Locomotive

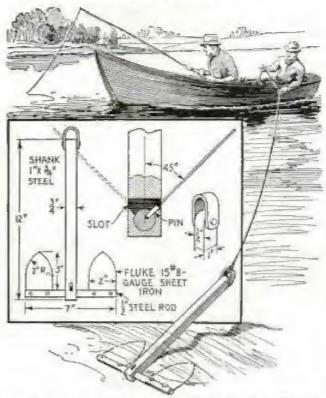
Model railway builders who have trouble in getting a reversing switch that is sufficiently compact for the limited space available in a locomotive will find a radio toggle switch of the type shown ideal for the purpose. It must be of the double-pole, double-throw type having six terminals, which are wired according to the diagram. The terminal lugs at opposite ends of the switch are cross-connected, then wired to the field coil. The center terminals are connected to the third-rail shoe and motor brush as shown. A ½-in. hole drilled in the desired position on the cab or frame serves to mount the switch.

■When you have a hole in your pocket, turn the latter inside out and cover the hole with adhesive tape.



Electric Motor in Model Locomotive Reversed by Radio Toggle Switch Mounted in Cab

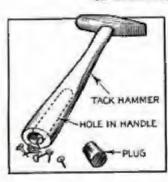
Light Anchor for Small Boats Is Made Easily



Lightweight Anchor Has Movable Flukes, Which Dig into Lake Bed and Hold Boat Securely

Here is just the type of an anchor you have wanted for your small boat. It is light in weight and will hold your boat securely. The shank is a length of bar iron or steel, having a clevis at one end for the anchor chain, and a hole drilled near the other end to take a 1/2-in, steel rod. The latter is slotted with a hack saw at both ends to take the flukes, which are riveted in place and move in a 45° arc. This movement is made possible by a slot in the shank just above the hole for the rod, as indicated in the cutaway view. A steel pin in the rod strikes the edges of the slot and limits the movement of the flukes.-Charles E. Albridge, Lima, Ohio.

Tacks Kept Handy in Hole in End of Hammer Handle



Kept in a hole drilled in the end of a hammer handle, tacks are always at hand, and will save you many steps in looking for them when needed. A

%-in. hole drilled 3 in. deep into the handle will hold a small box of tacks, and it can be plugged with a cork or a short piece of dowel rod.

Motor Used to Twist Cords

When making woven articles, it is often desirable to twist narrow strips of Cello-

phane, crepe paper and other materials into strong cords or ropes. A quick method of doing this is to use a hand drill or a small motor fitted with a chuck. One end of each strip to be twisted is attached to a screw eye, which is



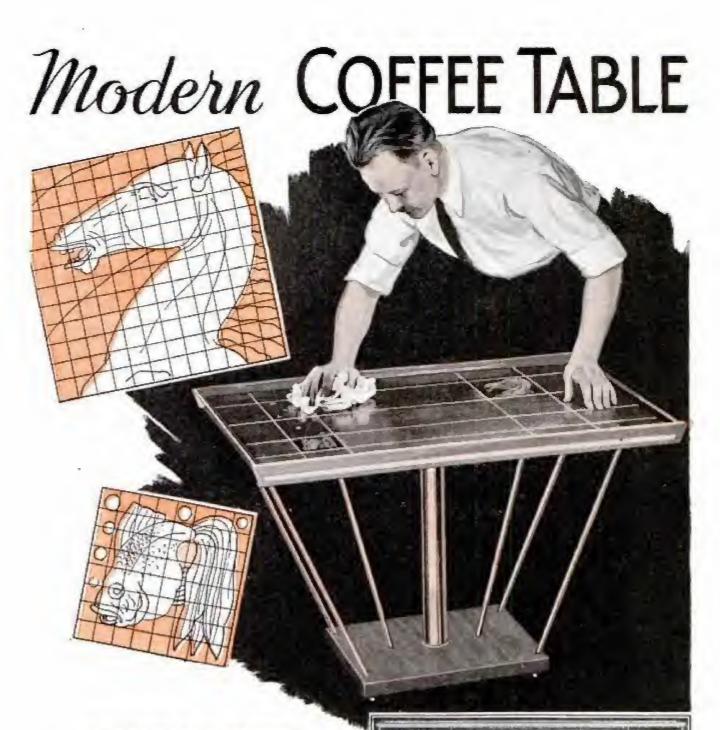
clamped in the chuck, while the other end is fastened to a wall or workbench with a bent nail or screw eye.

Child's Whirligig Toy Made from Ten-Cent Drill

Whirling at a merry spin with toy animals playing "follow the leader," this whirligig will prove an interesting toy for your youngster. It is made from a wood disk and a ten-cent push drill, the shaft of the latter being mounted on the disk so that the toy will spin when the push knob is pressed down. The animals are cut from thin plywood and are painted in appropriate colors, making the outlines and necessary markings with black enamel. The toy will spin on any level surface, but if it is to be used on a rug, it is a good idea to make a supporting disk or cone with a hole in the top in which to spin it.



Whirligig with Animal Cutouts Makes an Attractive and Interesting Toy for Your Child

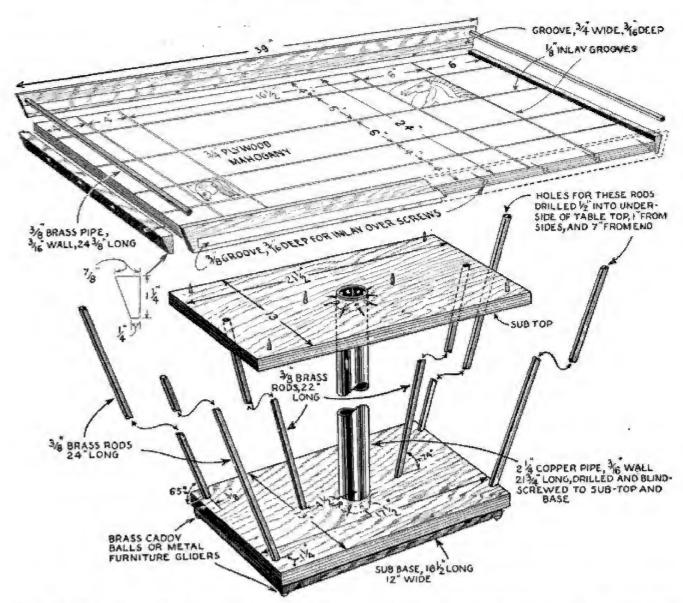


By OSKAR J. W. HANSEN

THIS modern coffee table incorporates both wood and metal, a large copper column forming the main support for the top, and six brass rods assuring the necessary rigidity. Inlay work and two copper plates in repousse greatly enhance the top.

Five-ply, ¾-in. mahogany veneer is carefully squared and grooves are cut for inlay strips. The grooves are ¾6 in. deep and as wide as the saw blade or dado cutter. In this case the width of the dado cutter used was ⅙ in. Before inlaying the strips, make the repousse pieces of .0005-in. sheet copper, allowing an extra ¾6-in. width at each edge for bending into the inlay grooves. To be sure that the edges

are bent over at right angles, press them over a square piece of plywood, cut to the exact size required. Now crosshatch the reverse side of the copper in ½-in. squares, trace or draw in the design and press the outline into the metal with the rounded edge of an old wood chisel. Next, lay the

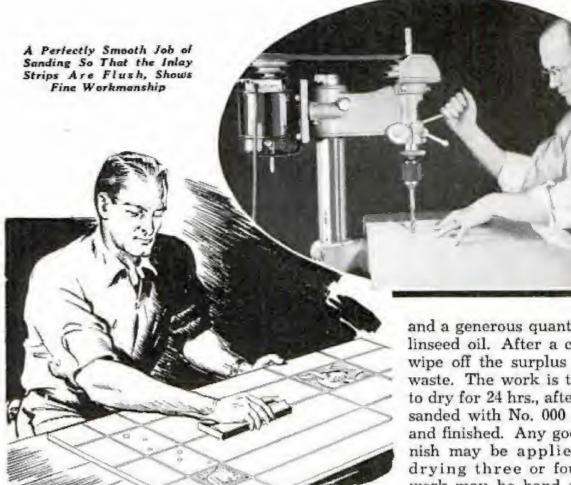


copper on a piece of corrugated cardboard and, with an orange-wood manicuring stick, press down the spaces inside of the outline to the desired depth. It is well to practice doing this on some scrap pieces of copper before making the piece you are to use on the table. After the repousse pieces have been finished, check carefully to see if they fit snugly around the edge of the portion to be covered. Then mix some shellac with plaster of paris to make a soft paste, which is smeared on the underside of the copper, filling all the depressions, and the piece is pressed into position permanently. After polishing the copper, apply a coat of transparent metal lacquer to prevent tarnishing.

For inlay strips, use a light wood such as white holly. For the portion around the repousse pieces, special strips have to be cut of narrower width than the rest, to make allowance for the copper. Apply a thin, even coat of glue to the strips so that

there will be no excess to smear up the work, which will interfere with finishing. One way of getting the glue on evenly is to draw the strip through the crease of a folded piece of flannel, previously coated with glue. The side rails are % by 2-in. mahogany plywood. Holes to receive 3/8in, rods or tubes are drilled at the ends of the rails and about two-thirds through them. Then both sides are grooved, the inside to fit the edge of the top and the outside to accommodate screws for attachment. A strip of light wood is later inlaid to fill the grooves. From the drawing you will also note how a beveled strip of mahogany is screwed to the ends of the top. Another method of attaching it is to use dowels in blind holes.

Next, the sub-top is cut from 1-in. white pine and drilled for the 2¼-in. center column of heavy copper tubing and for the two inner braces, which are %-in. brass rods, set at the angle designated. The end



of the column is drilled for wood screws. which are used to attach it to the sub-top and base, as shown. The sub-top and base are drilled clear through while the hole may be continued into the top and subbase about 1/4 in. deep to receive the end of the pipe. In drilling the holes for the brass rods, note that the two inner ones are set at a different angle than the four outer ones. Their exact location is carefully plotted and a jig is fixed on the drill press to drill the holes accurately. The tops of the outer rods go 1/2 in. into the underside of the table top. Small holes are drilled through the rods, near the ends, for slender wood screws to hold them snugly in position. At the bottom these screws are driven into the underside of the base. After assembling the top, sub-top, column, braces and base, the sub-base is screwed on and four caddy balls or furniture glides are fitted to serve as feet.

You are now ready for finishing. First apply a light filler, consisting of benzine, whiting, a little raw sienna or burnt umber and a generous quantity of boiled linseed oil. After a couple hours wipe off the surplus with cotton waste. The work is then allowed to dry for 24 hrs., after which it is sanded with No. 000 sandpaper and finished. Any good spar varnish may be applied and after drying three or four days, the work may be hand rubbed with rubbing felt to which has been applied rubbing oil and powdered rottenstone. A final fine rub may

be given by a dry felt and whiting or silica. French polish is more difficult. One takes a clean linen rag and makes a pad. To this pad a quantity of white shellac and a small quantity of oil are applied. Then at once to this a certain amount of denatured alcohol is added and the work is rubbed with a brisk motion. The quantity of each of these ingredients varies with the progress of the work and can only be learned by experience and observation. Enough oil should be used so the pad will glide easily; enough alcohol to make the shellac liquid without disturbing the layer already applied. A waxed finish may be had by applying any good grade of paste wax and rubbing it vigorously with a flannel cloth to a high polish.

■Turpentine, or a solution of oxalic acid, applied to the tops of enameled letters, on glass, and allowed to soak down through the cement, will loosen the latter so that the letters can be removed from a window without any trouble.

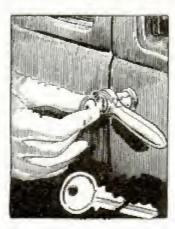


Sturdy Hobby-Horse

One of the long leaves from a discarded auto spring supplies the "action" for this hobby-horse. The frame, which consists of a length of 2 by 4-in. hardwood slightly longer than the leaf, is held on edge by fitting it into notches cut in crosspieces. Flat-iron stirrups are bolted, or clamped to the spring between the saddle and horse's head, and serve as bumpers that strike the floor when the rider puts the horse into a "gallop." Pieces of rubber hose are slipped over the stirrups to cushion the bump. The horse's head is cut from plywood and has a 6-in. length of dowel rod run through it to serve as handles.

Just One Key Fits This Lock

If you are suspicious that there are supplementary keys to a cylinder lock, here is a method of fixing it so that only one key will fit it. With a fine coping saw, cut your key in half as shown. Cut it at an angle so that the pieces will fit together only when placed right side up. Then insert the tip end of the key into the lock

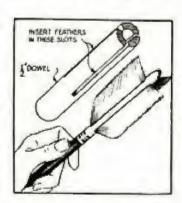


as far as it will go. When the remaining part of the key is inserted into the lock it will work, but when any other key is used, the piece inside serves as an obstruction.—William H. Leach, Cleveland, Ohio.

Jig for Gluing Feathers to Arrows

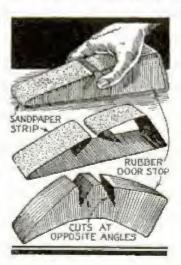
Here is a handy jig that was used by one archer to glue feathers to his arrows. It is a short length of ½-in. dowel rod, which

is drilled lengthwise through the center to take the arrow snugly, and slotted at one end to take the feathers. The slots hold the feathers in alinement while the glue is drying, after which the jig is slipped off. To



prevent the jig from becoming fastened to the arrow, the hole in the dowel is made slightly larger at the slotted end.

Rubber Doorstop Used as Sanding Block



Here is a sanding block to which the paper may be attached or removed in an instant. Two cuts are made at opposite angles in one side of a rubber doorstop to receive the ends of the sandpaper strip, which is wrapped lengthwise around it. The rubber, on

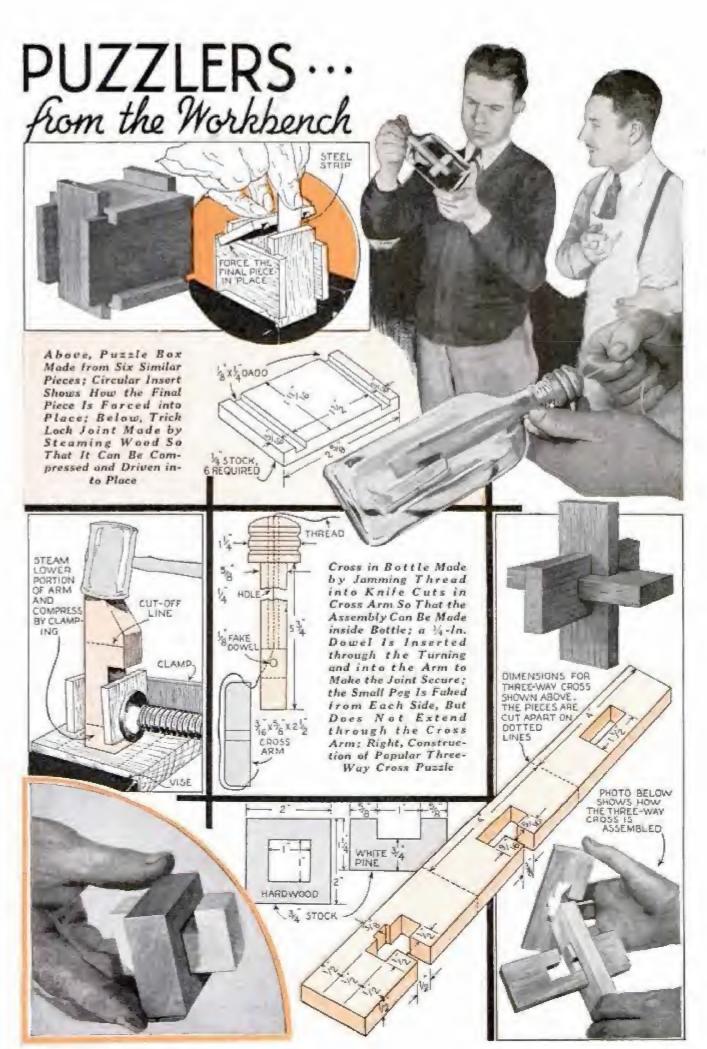
resuming its original shape when released, grips the paper and stretches it to provide a smooth sanding surface.

Cork Connects Broken Glass Tubing

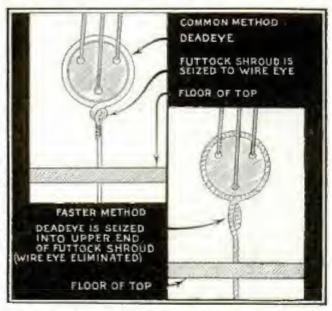
A broken glass tube can be repaired by inserting the ends tightly into a hole

drilled lengthwise through a bottle cork. The repair will be handy for glass tubing used on chemical apparatus which would have to be replaced if the broken part could not be repaired.





Attaching Topmast Deadeyes on Ship Models



Simple Method of Attaching Topmast Deadeyes

When the lower row of topmast deadeyes rest on the floor of a top, ship-model
plans usually specify that these are to be
stropped with wire, thus forming a loop
on the bottom of the deadeye through
which a thread is attached to lead downward to a fastening with the lower mast
shrouds. While this method truly copies
actual ship practice, a faster method, and
one that will save some work by eliminating the wire strop, consists of seizing the
deadeye into the looped end of a thread,
which then is passed down through the
floor of the top and fastened to the lower
shrouds.—H. T. Bodkin, Chicago.

■Oil paint often has a tendency to wrinkle upon exposure to extreme cold, but this may be prevented by thoroughly mixing a little turpentine with the paint.

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POPULAR MECHANICS MAGAZINE, Dept. B.P.E., 200 E. Ontario St., Chicago



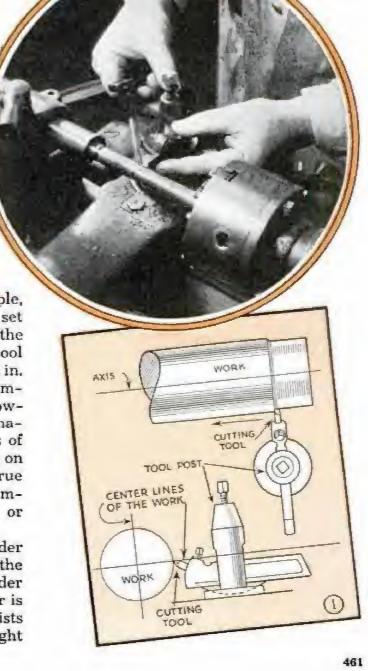
How to Set Your METAL-TURNING TOOLS

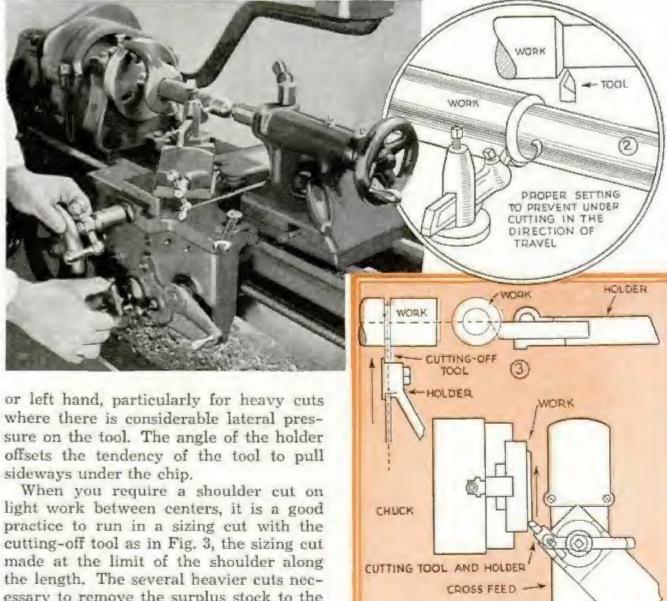
by W. Clyde Lammey

SMOOTH cuts on metal are the result of a properly ground cutting edge and a correct setting of the tool with relation to the axis of the work. In turning down straight cylindrical steel under 1 in. diameter the cutting tool is set exactly on the axis of the stock as in Fig. 1. This position of the tool tends to lessen the bending strains on work of small diameter mounted between centers. On heavier materials in steel, bronze and cast iron the cutting tool will lift the chip more cleanly if it is

set slightly above the axis. As an example, if your stock is 1 to 1½ in. in diameter, set the cutter approximately ½2 in. above the center line. On larger diameters the tool can be raised proportionally higher; ¾4 in. above the center for each inch of diameter of the stock. These settings vary, however, with the kind of metal and the nature of the work. To turn down brass of any diameter the tool is invariably set on the axis of the stock. The same is true when you are facing small or large diameter disks or castings in the chuck or mounted on a faceplate.

It is also important to set the tool holder at right angles to the axis, as in Fig. 1, the tool being supported in a straight holder in this case. Though the straight holder is better for certain types of work, machinists generally use an angle holder, either right





essary to remove the surplus stock to the required diameter can then be run up to the sizing cut with a tool ground and set as in Fig. 2. This method leaves a very smooth surface that requires little extra finishing and avoids any possibility of undercutting either at the shoulder or along the length as the cut is progressing. Fig. 3 shows the setting of the cutting-off tool. The only precaution to be taken in setting the cutting-off tool is to see that it is set exactly at right angles with the axis of the work. If it is set even slightly out of line it is likely to bind and break in a deep cut. To assure safety about the metal lathe it is necessary that the operator take every precaution against breakage.

Fig. 4 shows the operation of facing work in the chuck. You have probably noticed that there is considerable slack between the tool holder and the opening in the tool post. It is important in certain operations, of which this is an example, that the slack be taken up when the tool is set. Note that when the tool holder is placed in the slot it is turned so that it bears against opposite sides of the slot, which is indicated with dotted lines, and the tool-post screw is then tightened with the holder in this position. This prevents the tool holder from slipping sidewise on the rocker and drawing into the work. With the tool set in this position, it would be necessary that the strain be great enough to move the whole tool-post assembly.

(4)

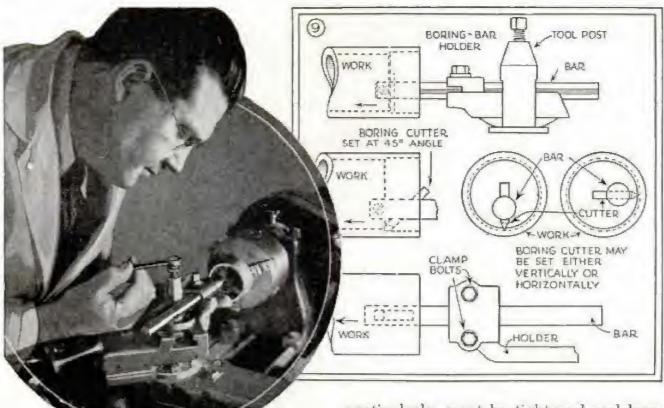
The same rule for setting the cutter on the center line holds when cutting threads with a special threading tool as shown in Figs. 5 and 6. The threading stop, Fig. 7, is handy when cutting threads on a small lathe as it provides a means of accurately setting the tool for depth at each pass along the work from the first light scoring, as in Fig. 8, to the final finish cut to complete the thread. The principal reason for failure in cutting threads is an improper setting and the attempt to cut far too deep at each pass of the tool along the work. The danger of irreparable damage to the thread is during the last two or three cuts just before the thread is brought to its final form. Make sure before the thread is started that the tool-post screw is drawn down tight so that the WORK THREADING TOOL THREADING TOOL IS SET CROSS-FEED AT RIGHT SADDLE ANGLES THREADING WITH WORK CROSS-FEED SCREW FIRST SCORING

holder cannot shift out of position. Be sure also that the cutter is set exactly at right angles to the work and on the horizontal center line.

CUT IS VERY LIGHT

Fig. 9 details several common methods of setting a boring tool of the conventional type. The details require little comment as they clearly show the generally accepted practice. However, no infallible rule covers the setting of the boring tool even on the common types of work. It often happens that the tool will show a tendency to chatter, which is most difficult to overcome. Should this happen, first check the holder for alinement, change the setting or the depth of cut slightly, change from the power feed to hand feed if you have been using the former and make sure that the cutter and the bar are tight in the

holder. Occasionally a stubborn chatter can be eliminated by setting the tool from a vertical to a horizontal position and adjusting the cutting point slightly above or below the horizontal center line. Also a washer of paper or thin leather placed under the tool-post ring will sometimes correct the trouble. When cutting internal threads the threading tool is held in the bar in the same manner as the boring tool, but must be set horizontally in order to obtain the necessary close adjustment for depth. Always keep the tools and cutters ground and honed sharp. If you do not ordinarily wear glasses, it is good practice to put on a pair of industrial goggles when you work around your lathe. The goggles are not uncomfortable to wear and they may save your eyes from a flying chip of



metal. Another care one should observe in setting lathe tools is to avoid drawing the setscrews and bolts on the carriage and tool post too tightly. The tool-post screw, particularly, must be tightened and loosened many times in the course of a single job. If undue pressure is used on the wrench, looseness and inaccuracy are likely to result. Tighten the screw just sufficiently to keep the cutting-tool holder firmly in place.

Centering Eccentric Shafts

Here is one of the best methods I have found for centering a shaft eccentrically in a milling machine, especially where the limits are critical. The shaft is held in a universal vise and, after centering one end, a dial indicator, which is set up as shown,

COLLAR TO HOLD
IMDICATOR ROD

VISE

DIAL INDICATOR
SHAFT

Method of Centering Shafts Eccentrically in a Milling Machine to Assure Accuracy

is adjusted until the indicator reads zero, after which the other end is centered. Now, the table is moved the distance E, which is equal to the eccentricity of the shaft, and the above process is repeated.—Charles Kugler, Philadelphia, Pa.

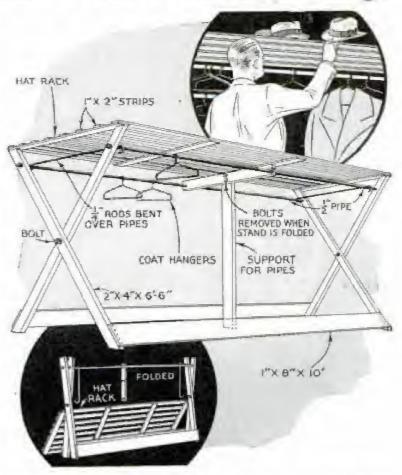
Saving Straw That Is Harvested with Combine Thresher

Saving straw at a low cost is an important problem on many farms where combine harvesters are used. For stacking outdoors, many pick up the straw windrowed by the combine with a buck rake, and then stack it with a grapple fork. Another good way of stacking or putting the straw into a barn, is to load the windrow with a hay-loader onto a basket rack, using slings to unload the rack, one being used on the bottom of the rack and the other about halfway up the load. Hitching a wagon or trailer behind the combine, and blowing the straw directly into the rack takes less labor and saves the chaff.

Portable Hat and Coat Rack Folds for Storage

Folding flat so that it can be stored or transported on the running board of a car, this rack will accommodate about one hundred coats and hats. It is intended for temporary use in club rooms, meeting halls and similar places where cloak rooms are not available, and where some convenient rack for holding garments must be provided. Also, the rack serves nicely when the capacity of cloak rooms is overtaxed by large crowds. To get the necessary strength, in addition to compactness, it is best to use hardwood for the rack, although the upper part, which consists of 1 by 2-in. strips, can be made of pine or other soft wood, as there is very little strain here. Two folding X-braces serve as legs to support the rack, while lengths of pipe between the braces hold coat hangers. For additional strength when the rack is heavily loaded, a single leg supports it in

the center. The leg is bolted to a horizontal crosspiece, which is pivoted to one of the pipes and notched at the free end to slip over the other as indicated. In use,



iron rods, with hooks bent on the ends, are slipped over the pipes running along each side of the rack to prevent it from collapsing.—Frank Beatty, Chicago.

Vacuum Cups Increase Prominence of Advertising Signs



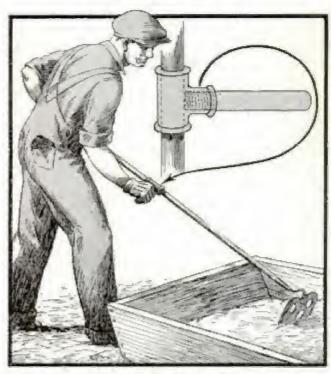
Merchant Increases Prominence of Advertising Posters by Suspending Them with Vacuum Cups To increase the prominence of his special-day advertising signs so that they attract attention to the public readily, a hardware dealer displays them above the sidewalk by suspending them from the handles of rubber vacuum cups, which he sticks to the store windows. When moistened with a little glycerine and pressed against the window, these cups adhere to the glass indefinitely. Posters and pennants are attached as indicated.

Starting a Nut on Marred Threads

When it is necessary to cut off part of the threaded end of a long bolt, first drive a nut up to the end of the threads. Then, saw off the end and unscrew the nut. This will remove the burrs where the threads were cut so that a nut can be started.

maybe hin Ce. 1436 W. Randalen

Auxiliary Handle Improves Masons' Mortar Hoe

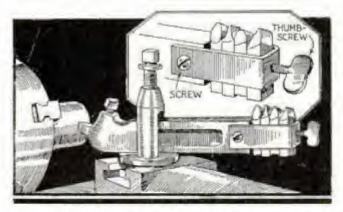


Adjustable Handle Makes Mortar Hoe Easy to Use and Relieves Wrist Strain

To relieve hand and wrist strain, when using a mortar-mixing hoe for long periods of time, one mason uses an auxiliary handle, which can be attached or removed in a moment. The extra handle consists of a pipe tee large enough to slip over the hoe handle, and a nipple which is threaded so that it may be turned into the tee to engage the wood. The extra handle is easily adjusted to suit.

Extra Cutting Tools Kept Handy on Tool Holder

To keep his cutting tools handy, one lathe operator attached them to the tool holder as shown in the detail. A thumb-

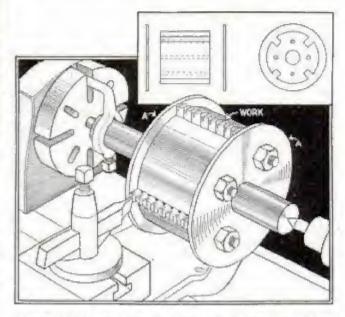


Cutting Tools Are Always at Hand When Clamped to the End of the Lathe Tool Holder

screw at the rear end of the improvised holder clamps the tools in place. It is loosened slightly when one of them is to be removed or replaced.—Peter L. Budwitz, Meriden, Conn.

Slotting Pins in a Lathe

In a small shop where there was no milling machine, this jig was used in a lathe to slot the ends of a number of steel pins. It is a piece of round steel having four equally spaced slots cut to a depth equal to a little more than one-half the length of the pins, and just wide enough to take



Jig Made Up to Slot the Ends of a Number of Steel Pins in a Lathe

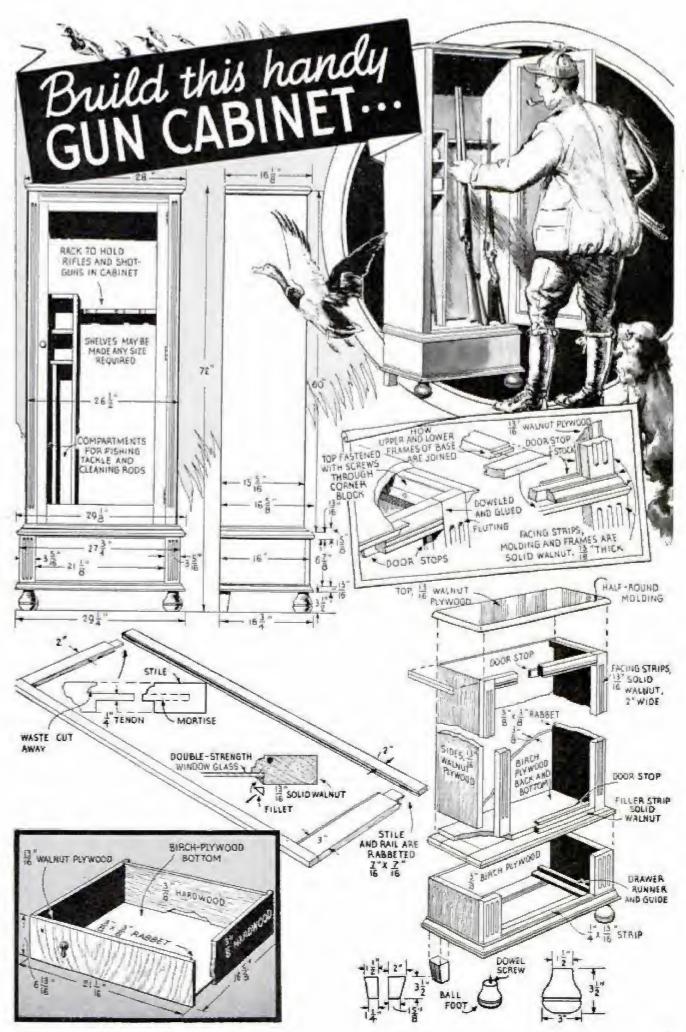
them snugly. The pins are held tightly in the slots by means of disks A, which are bolted in place as shown.

Jig for Sharpening Chisels

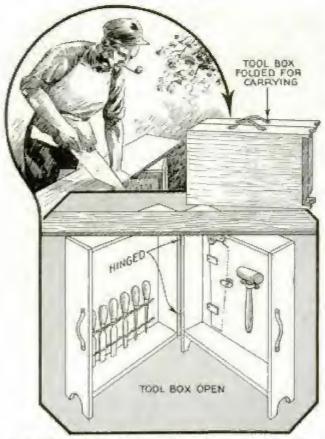
Difficulty of maintaining the correct bevel, when sharpening wood-cutting and turning tools, can be eliminated by using

this simple jig, which is especially useful with roundnose gouges. It is a block of wood with a hole drilled through it at an angle as shown. In use, both block and chisel are moved over the surface of the stone.





Hinged Tool Box Used as Sawhorse by Repairman

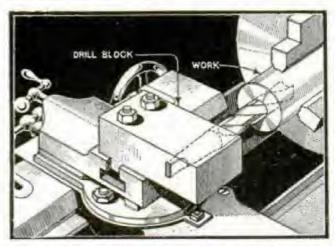


Hinged Tool Box with Short Extensions at One End Serves as Sawhorse on Odd Repair Jobs

Carpenters, who do screen or stormwindow fitting and similar work away from the shop, are frequently inconvenienced by lack of a sawhorse. If a stout folding tool box is made, as shown, it may be opened on the job and used as a practical substitute for the purpose.

Drilling in a Lathe

The practice of using large drills in the tailstock of a lathe is not only a tiresome

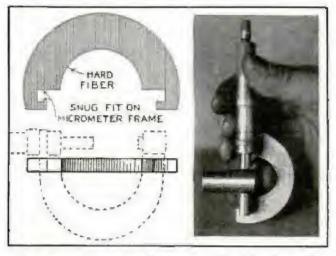


Drills Held in Block on Carriage to Avoid Damaging Tailstock When Drilling in a Lathe

job, but should the drill shank turn in the tailstock and score the hole, its center will be out of line with the live center in the headstock. To avoid this damage, workmen in one shop use the block shown, which is mounted on the compound rest, thus allowing the lead screw to be used to feed the drill to the work. In addition to the safety factor, use of the power feed was found to increase production. The block is held on the compound rest by bolts, and a tongue, machined on one side to fit in the T-slot, keeps it from turning. Drills are held in a tapered hole which is bored horizontally near the outer end. This hole is made to take the largest drill, reducing collets being used to accommodate smaller drills in the block.

Auxiliary Frame Makes Micrometer Easy to Read

When work that is finished to close limits is checked with a micrometer, the operator usually notes only the vernier lines



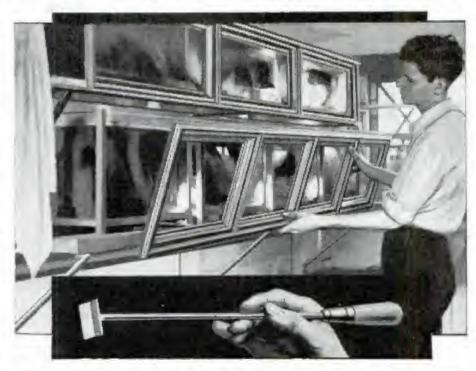
Auxiliary Frame on Micrometer Enables User to Hold Instrument to View Vernier Lines

of the instrument with an occasional reference to the thousandths reading. As a micrometer is not so handy when the vernier lines are watched exclusively, because these lines are at right angles to the thousandths reading, the user must bend his wrist sharply each time to bring the lines into view. To eliminate this trouble, a mechanic made an auxiliary frame from a piece of hard fiber and slipped it on the micrometer at right angles to the frame as shown. This permits the tool to be held just as comfortably as the regular frame, and the vernier lines are in full view.

Illuminated Tanks Improve Display of Fish

One shopkeeper who specializes in raising and selling fish, increases the effectiveness of the display by illuminating the aquariums, showcase lamps being arranged in the space between them. The lamps are concealed with attractively finished wooden frames set in front of the tanks. In order to reduce the cost of raising tropical fish, he circulates the water by means of a small rotary pump, driven with a 1/20-hp. electric motor. This was found much more economical than constantly drawing water from the city mains.

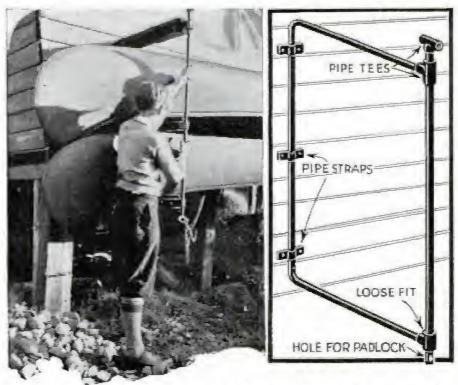
As a side line, which proved to be profitable, he sells aquarium scrapers, which are made by attaching old one-edge razor blades to suitable handles. The blades are brazed to 10-in, lengths of ¼-in, iron rods,



Stained Wood Frames Set in Front of Aquariums in Small Store Improve the General Appearance and Conceal Lamps That Illuminate the Fish

which are fitted with wood handles. In brazing the rods to the blades, care must be taken to get the latter at a slight angle to the rods so that the scraper can be used conveniently.

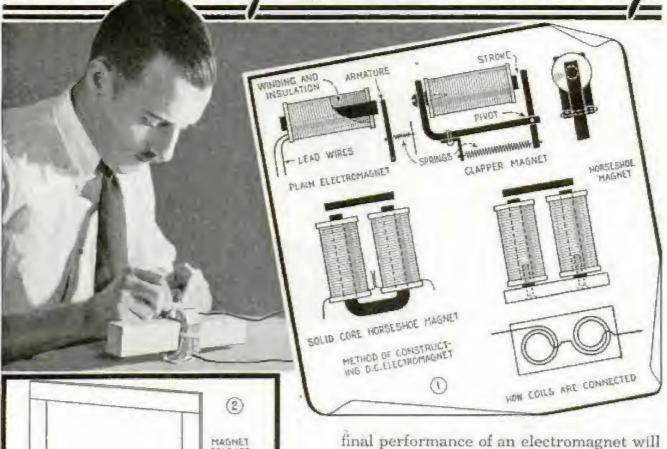
Rack Protects Your Canoe against Theft at Summer Camp

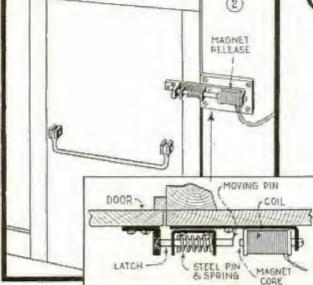


With This Rack, Which Is Made of Pipe and Fittings, You Can Lock Your Canoe Safely at Camp

At summer cottages, camps or boating clubs, this rack will help protect the canoes against theft. It can be attached to the side of cottage, garage or boathouse. The rack consists of two lengths of pipe bent to a large Ushape, the ends being fitted with tees. These take lengths of pipe, the upper ends being fitted with tees while the lower ends are flattened and drilled for padlocks as shown. The U-shaped pieces must be of a size to take the bow and stern of the canoe, yet small enough to prevent the wider amidships section from being pulled through them.

Designing and Building





By C. A. CROWLEY

You can design and build electromagnets for almost any purpose without becoming involved in the difficulties of complicated mathematics. In this article we have brought the subject down to a few simple rules, which, if followed carefully, will give results that are entirely satisfactory.

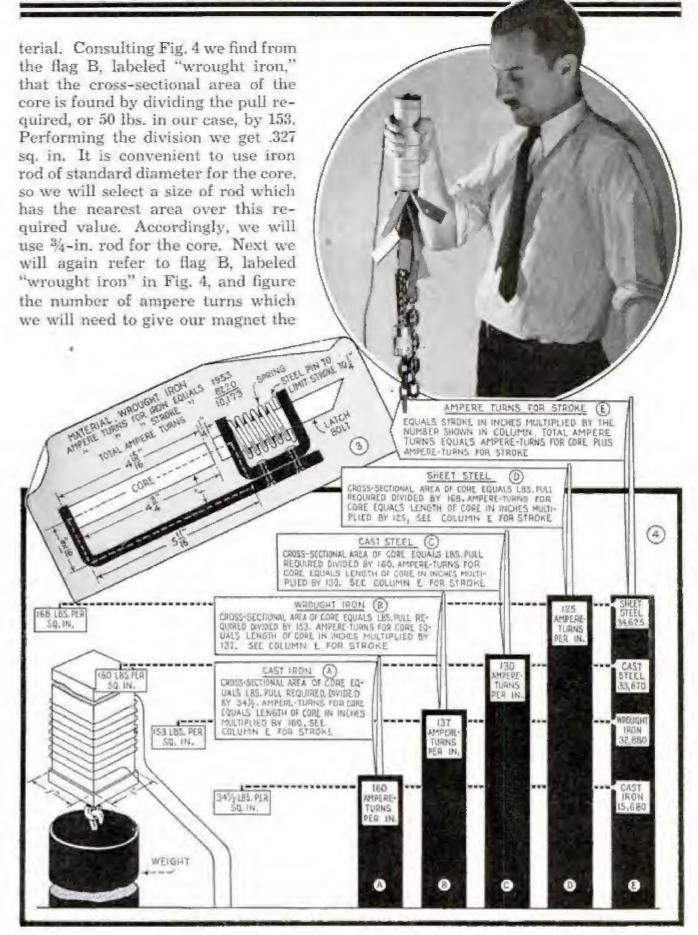
However, like any other piece of electrical apparatus in which iron is used, the final performance of an electromagnet will vary slightly from the figured value because it is not possible to look at iron and tell exactly how effective it will be. To make the work as accurate as possible, values for four grades of iron will be given.

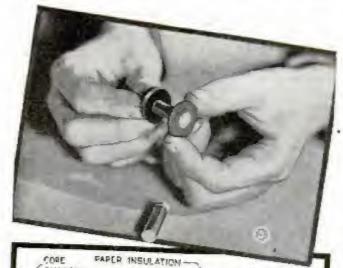
Direct-Current Magnets

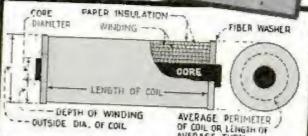
Although the general principles are the same for a.c. or d.c. magnets, we will start with the d.c. types, a number of which are illustrated in Fig. 1. In order to illustrate the method of design, we will show how to make a magnetic door latch, Figs. 2 and 3. In this latch the bolt stroke need only be 1/4 in. For long strokes, simple electromagnets are very inefficient. The first thing to do is to get a coil spring to hold the latch closed so that its tension can be tested. In the case illustrated it was found that a pressure of 25 lbs. was required to compress it 1/4 in. Now, as there will be considerable friction in operating the latch, it is advisable to design the magnet so that it will exert a pull of about 50 lbs.

The latch can be forged conveniently from wrought iron so we will make our magnet core and frame from the same ma-

ELECTROMAGNETS







DIMENSIONS FOR ELECTROMAGNETS

FOR DIAMETER OF CORE SEE FIG 4 LENGTH OF COIL EQUALS 6 TIMES THE
CORE DIAMETER. WINDING DEPTH EQUALS THE DIAMETER OF THE
CORE OUTSIDE DIA DF COIL EQUALS 3 TIMES THE CORE DIA.

AVERAGE PERIMETER OF COIL EQUALS 628 TIMES CORE DIAMETER

TO DETERMINE WIRE SIZE TO USE

FIRST, MULTIPLY THE VOLTS TIMES 12,000 SECOND, MULTIPLY AMPERE-TURNS TIMES AVERAGE PLRIMETER

THIRD, DIVIDE THE SECOND ANSWER INTO THE FIRST ANSWER.
THE RESULT IS THE WIRE SIZE IN OHMS PER
1,000 FT. FOR GAUGE NO. SEE WIRE TABLE

strength required. Here we find that the number of ampere turns required to magnetize the iron is found by multiplying the length of the magnet core by 137. Ampere turns is the name for the value found by multiplying the number of amperes flowing through a coil by the number of turns of wire in the coil. A coil, which passes 10 amperes and has 50 turns of wire, has 10 times 50, or 500 ampere turns. Similarly, a coil wound with 250 turns of wire and passing 2 amperes has 2 times 250 or 500 ampere turns. Before applying the formula to ascertain the number of ampere turns required, we will have to assume some reasonable value for the length of the coil and iron parts. A good rule to follow is given in Fig. 6. Applying this, our coil will be wound to a depth of 3/4 in. This means that the outside diameter of the coil will be 21/4 in. Multiplying 3/4 in. by 6 gives 41/2 in. as the length of the coil, To leave space for insulation, the iron core should be cut to a length of 4% in. Referring to the sketch of the magnetic latch shown in Fig. 3, we can readily add up the total length of the iron core. The length of the dotted lines represents the length we will have to measure. In other words, we must find out how far the magnetism

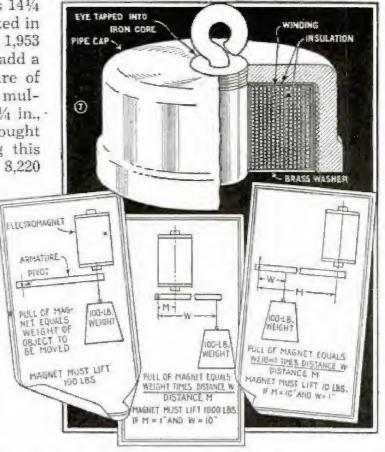
			TURNS PER SQUARE INCH				OHMS PER CUBIC INCH			
B & S or A. W G Number	Ohms per 1000 Ft at Cod Temperature	Circular Male	Enamel Covered	Single Cotton Covered or Double Silk Covered	Double Cotton Covered	Enameled and Single Cotton Covered	Enamel Covered	Single Cotton Covered or Dauble Silk Covered	Double Cotton Covered	Enameled and Single Cotton Covered
	764	16310								
9	963	13090				and the	0.00		-	
10	3 215	10.140	92.2	87.3	80	84.8	60765	.00725	00662	.00704
- 11	1.532	8234	116	110	97.5	105	.0321	0115	.0102	.0110
12	1 931	6530	146	136	121	131	0193	.0161	0160	.0173
13	2 436	5176	184	170	1.50	162	.0308	.0283	.0250	.0271
14	3 071	4007	232	211	163	198	0493	0443	.0385	.0417
15	3 8 2 3	3257	293	262	223	250	.078	.0097	.0592	.0665
16	4 684	2583	365	321	271	306	1.22	107	.0907	102
17	6 158	2048	464)	397	329	372	194	168	139	157
18	7 765	1624	572	493	199	454	304	263	.213	242
19	9 792	1288	718	592	479	553	+37	.397	318	.370
26	12 35	1022	912	273	623	725	774	657	.530	.613
21	15.57	\$10	1150	940	754	895	1.23	1.01	806.	.957
22	19 63	642	1430	1150	910	1070	1.91	1 54	1.22	1.43
23	24.76	. 510	1790	1400	1080	1300	101	2.38	1.62	2.20
24	31.22	404	7240	1700	1260	1570	4.78	3.64	2.70	3.57
25	39.30	320	2870	2060	(310	1910	7.66	5.61	4 10	5.18
26	49 04	254	3560	2500	1750	2300	12 1	8.50	5.95	7.82
27	62 19	202	4420	3630	2020	2780	190	13.0	8.66	119
28	78 93	160	5580	3670	2310	3339	30.2	19.8	10.5	181
29	99.52	122	6900	4300	2700	3900	47.3	29 5	18.5	26.7
50	123 5	101	6700	5040	0030	6660	75.2	416	26.2	40.3
31	158 2	80	10000	5920		5280	416	64 0		570 .
32	199 5	63	11500	7000		6250	185	96.5		85.5
33	251.6	50	17000	8120		7.560	293	140.		127.
34	317 7	40	21100	9600		8300	460	209		181
33	*00 1	32	26300	10900		8.700	771	300		266
36	504 5	25	37060	12200		10750	1110	422		370
33	636.2	20	39600				1740			
38	902 Z	16	49400				2710			
59	1012	15	61200				425B			
40	1276.	10	7 ft. 1 Date				6550			

must travel through iron. This totals 14¼ in. Multiplying this by 137, as indicated in Fig. 4, under "wrought iron," we get 1,953 ampere turns. In addition, we must add a number of ampere turns to take care of the stroke. This amount is found by multiplying the length of the stroke, or ¼ in., by the number shown opposite "wrought iron" under the flag E. Multiplying this number, or 32,880, by ¼ in. we get 8,220

as the number of ampere turns to be added. Adding 1,953 to 8,220 we get 10,173 as the total number of ampere turns required for the coil. This same procedure may be used for any d.c. magnet. In all cases the total length of the iron through which the magnetism must pass to make a complete circle, must be measured. In case a core is used which does not have a return path for the magnetism, only the core length and length of stroke are considered in figuring the ampere turns required for magnets having short strokes. For

long strokes, solenoids or plunger magnets should be used. Construction of solenoids will be explained completely in another article entirely devoted to this subject.

Next we figure the size of wire required to wind the coil. Fig. 6 shows a simple rule for doing this. After figuring the average perimeter, which, according to the rule, is 6.28 times the core diameter, or in this case 4.71, we can then determine the wire size to use. If the coil is to be operated on 110 volts d.c. we first multiply this voltage, or 110, by 12,000, which gives us 1,320,000. Next we multiply the total number of ampere turns found as above, or 10,173, by the average perimeter, which we have just figured, or by 4.71, which gives us 47,915. Then we divide this number into 1,320,000, which gives us 27.55 ohms as the resistance of 1,000 feet of the size wire we need. Referring to the wire table, we find that this resistance corresponds to a size of wire between Nos. 23 and 24. We may choose either of these. The larger, or No. 23 wire, will increase the strength of the magnet slightly and cause it to become somewhat hotter; however, as this magnet is to be used intermittently, No. 23 wire may be used without danger of overheating. In winding the



coil figured by these methods, it is not necessary to count the turns of wire, as the selected size of wire will produce the correct number of ampere turns regardless of the exact number of turns wound. Changing either the voltage or the coil diameter will prevent the coil from performing as it should. The coil may be increased in length or shortened without changing the number of ampere turns or strength. If the coil is shortened it will run hot and if it is lengthened it will run cooler and consume less current but will deliver the same pull. Washers of suitable size to slip over the core tightly as in Fig. 5, should be made from bakelite or fiber. The outside diameter of the washers should be slightly over the outside diameter of the coil. With the end washers in place, the iron core between them is covered with two or three layers of heavy brown paper. This should be held in place with shellac, which also improves the insulating quality. One layer of paper should be placed between every two or three layers of wire for added insulation. Wire with any type of insulation may be used without changing the ampere turns in the coil. When the coil is finished, it is a good idea to coat it with shellac as shown in Fig. 14.

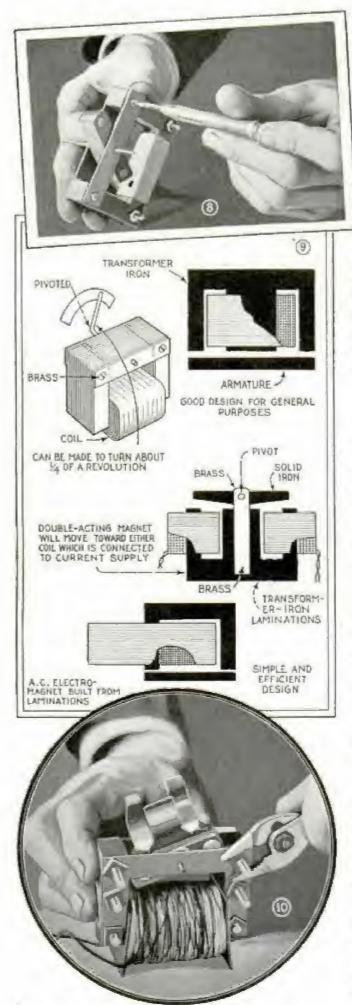


Fig. 7 shows a simple design for a lifting magnet. The frame for this type of magnet may be built from a pipe cap. The core is turned from a piece of cast iron or steel. The number of ampere turns required for a magnet of this type is figured exactly as explained above except that no allowance is made for stroke. Other special types of magnets may be worked out by similar methods. It must be remembered that enclosed windings or short coils tend to pull more amperes and therefore get hotter

than long-exposed coils that can radiate their heat. Magnets used to operate systems of levers must be designed to allow for the variation in pull required due to the lever system. Some simple methods of figuring the pull required of lever magnets are given in the three details which are shown below Fig. 7.

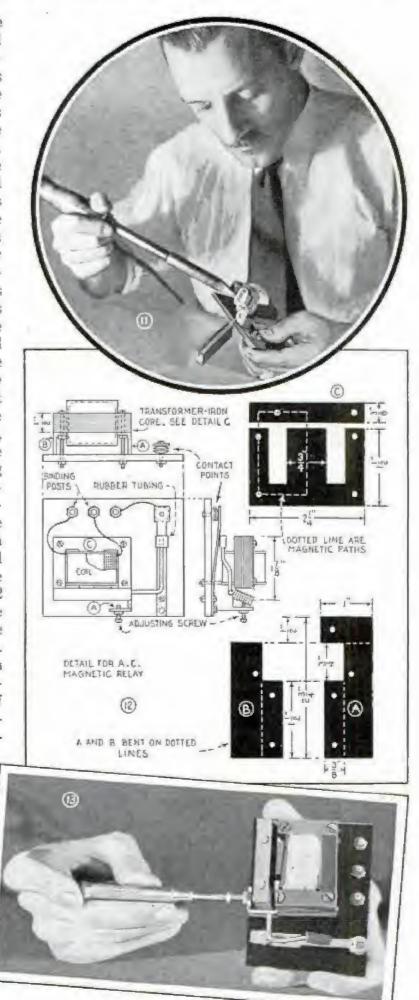
Alternating-Current Magnets

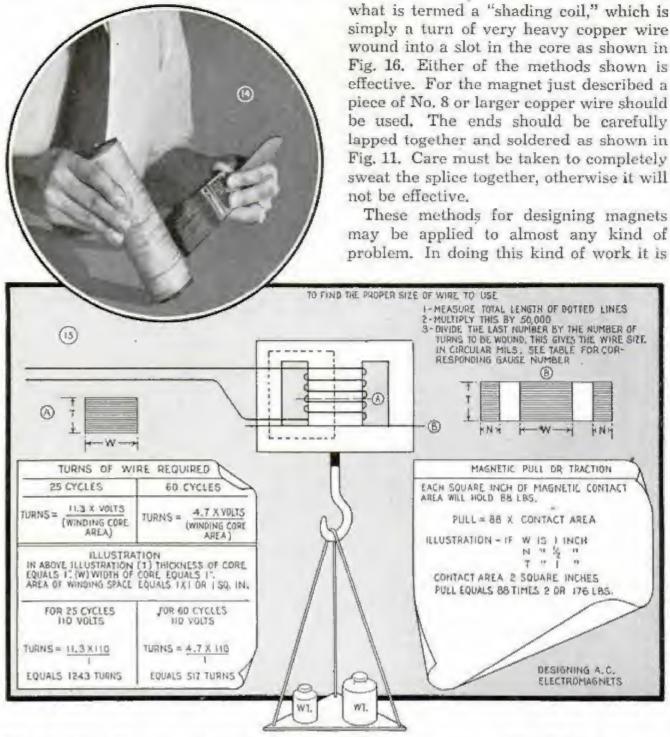
Alternating-current electromagnets may be designed for many purposes if care is taken to design the metal parts so that the iron makes a complete circuit around the coil when the magnet arm is closed. Plain magnets without a return path for the magnetism are not satisfactory for a.c. The cores for a.c. magnets must be built up from sheets of steel the same as the core of a transformer. Fig. 9 shows a number of a.c. magnets. Silicon steel or stovepipe iron, tightly assembled by means of stove bolts, as shown in Figs. 8 and 10, may be used for the cores of this type of magnet, The moving part, or clapper as it is called, may be made from solid metal if it is small, but the core upon which the coil is wound must be built up from laminations as shown: otherwise trouble will be experienced from excessive heating.

To make clear the application of simplified methods for designing a.c. magnets, we will construct an a.c. magnet suitable for closing an electrical switch. Magnets that are arranged to close or open electrical switches are called relays. Inasmuch as the core from an old transformer is usually available we will use one of these for our magnet. A sketch of the core together with the mechanical arrangement is shown in Figs. 12 and 13. From the sketch we can see that the length of the iron face that will be effective in giving pull to the mag-

net is divided into three parts. The outside legs are 3/8 in. wide and the center leg is 34 in. long. Adding these together gives 11/2 in. as the total length of the effective pulling surface. Multiplying this length by the thickness of the core, or 1/2 in., we get 3/4 sq. in. as the cross-sectional area of the core that is effective in giving pull to the magnet. For a.c. magnets it is safe to figure that each square inch of pull surface will produce a pull of 88 lbs. The pull of our magnet will therefore be 34 multiplied by 88 or 66 lbs. As this value is ample for our purposes we will use the core as it is. The number of turns of wire required for the coil will depend upon the voltage to be used and upon the frequency or cycles of our current supply. If our magnet is to be operated on 110 volts, 60 cycles, a.c., we see from Fig. 15 that the turns are figured by multiplying the voltage by 4.7 and then dividing this answer by the crosssectional area of the core. The cross-sectional area of the core in this case is the cross-sectional area of the leg upon which the coil is wound. Referring to Fig. 12 we see that this leg is 34 in. wide and 1/2 in. thick. Multiplying these together gives us 3/8 or .375 sq. in. as the cross-sectional area. Then the turns are found by multiplying the voltage, or 110 by 4.7 which gives us 517, and then dividing this number by the cross-

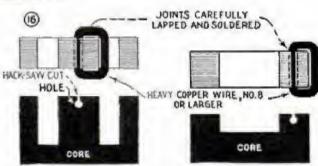
sectional area, or .375, which gives us 1,352 as the required number of turns. The method of figuring the wire size is also indicated in Fig. 15. Applying this rule, we first measure the length of the shortest path through which the magnetism must pass. This is indicated by dotted lines in Fig. 12, and totals 4% or 4.875 in. Applying the rule for wire size, we first multiply 4.875 times 50,000, which gives us 243,-





750. Dividing this number by the turns, or by 1,352, gives us 180 circular mils as the wire size required. Referring to the wire table, we find that this falls between Nos. 27 and 28. As we do not require the full power of the magnet for operating the relay, we will select the smaller wire size, or No. 28. The coil may be wound on a form and installed on the core by the same methods as are used in transformer construction. Before the coils are fitted over the cores, the latter are covered with insulating paper.

Alternating-current magnets tend to hum badly unless they are equipped with



SHADING COIL TO STOP HUM IN A.C. MAGNETS

best practice to figure out the design you need and then make minor variations by experimenting until you get exactly what you want.

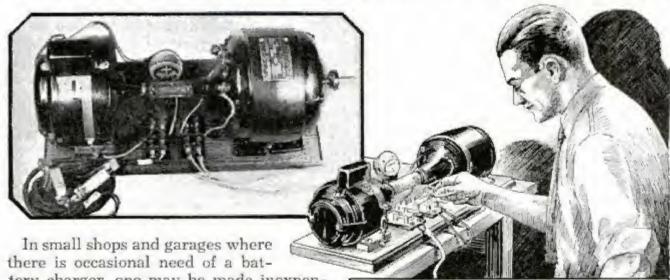
XIZ BOLT

WEOD SLEET

WIRE THROUGH

HEAD OF SOUT

Old Auto Generator Used as Battery Charger



HOSD -

STRAP

BASE

MOUNTING BLOCKS

In small shops and garages where there is occasional need of a battery charger, one may be made inexpensively from a ¼-hp. electric motor and an old 6-volt auto generator. The motor and generator are mounted on a base so that their shafts are in perfect alinement. They are coupled together by means of a short length of garden hose, as shown in the lower right-hand detail. The generator should be wired to the battery through a switch, and the electrical cut-out of the generator is retained to prevent discharging the battery should the motor happen to stop. An ammeter wired in series with the battery, will show the charging rate. This should not exceed 10 amps. at the be-

ginning of the charge, and should be reduced gradually to 2 amps. as the battery becomes charged. As most auto generators can be set to produce at least 20 amps, two or three 6-volt batteries, wired in parallel, may be charged at the same time.

GENERATOR

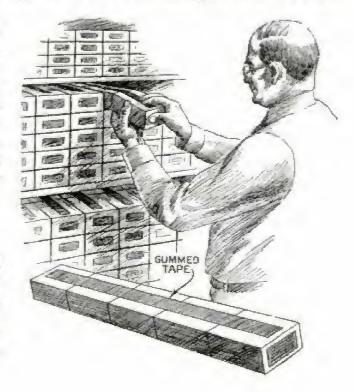
TURNBUCKLE

Gummed Paper Tape to Keep Small Packages in Order

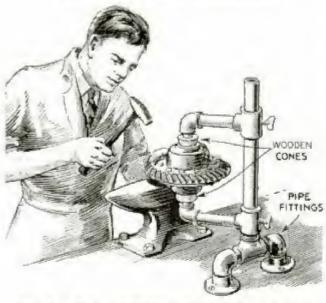
To keep small packages of screws, brads, tacks, etc., from becoming mixed on his shelves, a hardware merchant uses the following novel method: Packages containing one size of screws are laid end to end for the depth of the shelf, and are held together with a strip of gummed paper tape, which is fastened to the top side of each row. When needed, the top row is simply pulled forward and a package torn off.—Wayne C. Leckey, Aurora, Ill.

To Grow Beautiful Roses

Among the precautions to be observed in the successful growing of roses, perhaps the least heeded is the necessity of adding iron to the soil. A handful of iron shavings, buried around the roots of a rose bush, will rapidly rust and the iron will then be available as plant food.



Pipe Stand Holds Differential

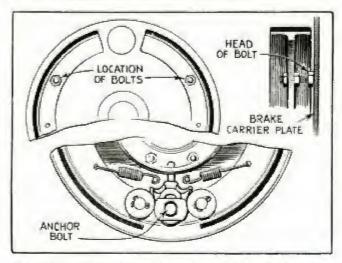


Stand of Pipe and Fittings Holds Differential for Riveting the Ring Gear in Place

Riveting a ring gear to the differential case is usually a two-man job, but with the use of this adjustable stand, one man can handle the job easily. With a few odds and ends of scrap pipe, a good stand may be made. The vertical pipe should be 2 in. in diameter and 2 ft. long. The arms are of 1½-in. pipe, with an elbow and a 2-in. nipple on the end to hold wooden cones, which fit into the differential as shown. These cones are the type used in rolls of wrapping paper to mount them in a rack, and may be had at most grocery or drygoods stores.

Eliminating Brake Chatter

Some car owners who have had the brakes chatter, have effectively eliminated this trouble by installing ¼-in. bolts in

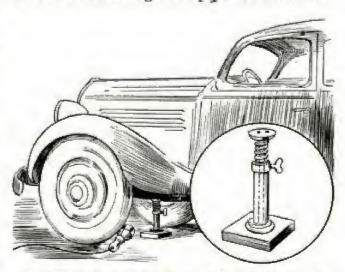


Two Ideas That Have Been Found Helpful by Auto Owners in Eliminating Brake Chatter

the brake shoes, as shown in the upper detail, so that the heads contact the brake carrier plates. The bolts should have a nut on each side of the brake-shoe web. This prevents tipping of the shoes when the brakes are applied. Other owners who have cars on which the brake shoes are controlled by a wedge, as shown in the lower detail, have eliminated chatter by filing about ½6 in. of the metal from the front side of the anchor bolt. This filing gives the bolt a slight horizontal motion so that the assembly is self-centering.

Adjustable Support Aids in Replacing Crankcase on Car Motor

The usual difficult job of replacing a crankcase single-handed is greatly simplified with this adjustable support, which is made from an old valve and a length of pipe. A cap on the upper end of the pipe is drilled for the valve stem and is tapped at one side through the pipe for a thumb-



Tool Made from Old Valve and Pipe Holds Crankcase in Place to Start Screws

screw, after which the assembly is mounted on a wood base by means of a floor flange. In use, the valve, which has a spring under the head, is pushed down to compress the spring where it is held with the thumbscrew. The tool is slid under the motor and the valve released to hold the crankcase in place until the screws can be started. Small blocks placed under the base will adjust the tool for height.

¶To wear down new brake linings that have a tendency to grab, drive the car a block or two with the brakes applied to wear down the high spots.

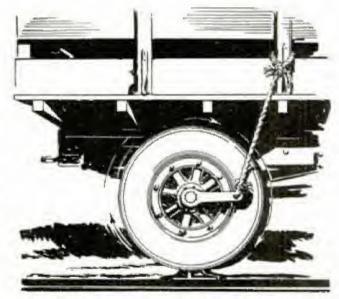
Rubber Gasket Destroys Reflectors in Auto Headlamps

Rubber should not be used as a gasket between the lens and reflector in an auto headlamp because the rubber contains sulphur. Decomposition of the rubber releases enough sulphurous acid to quickly destroy the finest silvered reflector. Headlamp gaskets should be made of small cotton rope laid carefully in the groove at the outer edge of the reflector. If a groove is not provided for this purpose, cork of the proper thickness should be used.

To Determine Whether Coil Spring Is Right or Left Hand

On page 959 of our June, 1935, issue the information on how to tell whether a coil spring is right or left was incorrectly given. On torsion springs, it is very important that the direction of loading the spring is the same as the direction in which the wire was wound. The coils of a righthand spring lie in the same direction as a right-hand screw; those of a left-hand spring can be similarly compared to a left-hand screw. Determining this is a simple matter by looking at the end of the spring. On a right-hand spring, the end of the coil points in the same direction as the bent index finger of your right hand, as shown in the illustration. On a lefthand spring, the end of the coil will point in the same direction as the bent index finger of the left hand.





Tight Hub Cap Removed by Tying Free End of Wrench to Body and Starting Motor

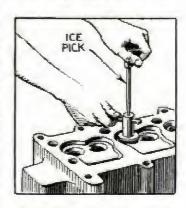
Removing Tight Hub Cap from Rear Wheel on Truck

I recently saw a driver remove a very tight hub cap from the rear wheel of his truck as shown. He first put the wrench on the cap and ran a rope from the free end of the wrench to the truck body. Then he jacked up the rear wheel and started the motor, putting it in low gear to loosen the right rear hub cap. The arrangement is just reversed for the left side.—Theodore Zeitz, Cleveland, Ohio.

Applying Pressure to Valve Reseating Tool

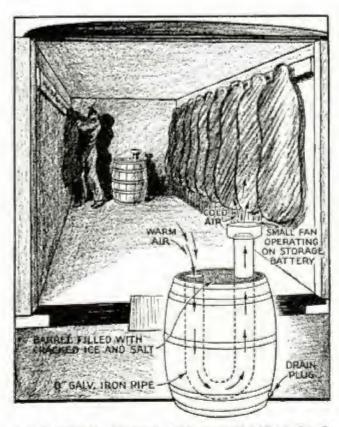
I have found an old ice pick handy for applying pressure to a valve reseating tool, as it is difficult to get the right pressure on

the tool by pushing down on the short handle provided. The end of the tool shank usually has a center mark in which the point of the ice pick can be held with one hand, while the handle of the re-



seating tool is turned with the other one. —E. T. Gunderson, Jr., Humboldt, Ia.

¶A piece of sheepskin with the raw wool on it makes a good windshield wiper that will keep the glass clear of frost and dew.



Air Circulated through Tube around Which Ice Is Packed Lowers Temperature inside Truck and Protects Perishable Freight on Long Hauls

Inexpensive Truck Refrigerator

Used by a large trucking company to protect perishable freight over a 400-mile haul, this inexpensive cooler operates at a cost of approximately five dollars for the entire trip. It is claimed that the cooler will keep the temperature inside of the truck at least 18° below the outside temperature. The cooler is a large barrel filled with cracked ice, which is packed around a U-shaped sheet-metal pipe. At the upper end of this, an electric fan is mounted to draw air through the pipe and distribute it through the truck. The fan is operated from the truck battery.

Replacing Ring Gear on Flywheel

To save time in replacing flywheel ring gears on Essex cars, first remove the transmission bell housing and then break off the old gear with a hammer and chisel. Heat the new gear and slip it over the flywheel. With this method, it is not necessary to remove the flywheel or clutch.

The Next Issue

A DROP-LEAF TABLE BY DUNCAN PHYFE

Copy of historical masterpiece owned by the Metropolitan Museum of Art. The original is considered one of the finest works of this master cabinetmaker. Table has concave feet, ornamented with distinctive Physe leaf carving.

DESIGNING A SOLENOID FOR EVERY PURPOSE

Tells you how to build a solenoid for almost any job. Practical information without complicated mathematics to figure size of core, wire, turns, etc.

METAL FINISHING IN YOUR HOME SHOP

Important shop practice of producing attractive finishes. Textures achieved largely by mechanical treatment. Also chemical treatments for colored effects.

EXPERIMENTS WITH AMMONIA

Practical experiments showing how ammonia is used in cleaners, polishes, insecticides, etc. Gives formulas to develop products for specific purposes.

SMART LAMP BASES

Stunning lamp bases of elegant, modern design that will go well with furniture of any kind and will also help materially to dress up your living room.



()ut of the House of Magic"

THE NEW METAL TUBE ... A DEVELOPMENT SO IMPORTANT THAT A COMPLETELY NEW RADIO HAS BEEN BUILT AROUND IT

In RADIO TUBES, glass now gives way to steel ... to new metal tubes* . . . created in the General Electric "House of Magic."

Tubes so superior that they need be only half the size of glass tubes . . . inspiring the making of a completely new receiver - the 1936 General Electric Radio!

Noises suppressed . . . brilliance gained

These new metal tubes have silenced forever the annoying crackle caused by "shielding cans" ... subdued the microphonic

> For 1936, General Electric offers, in addition to the new metal tubes, these notably new features that keep the set at "concert pitch"

G-E Permaliner G-E Sentry-Box G-E Stabilized Dynamic Speaker

G-E Tuning Bands for domestic and foreign broadcasting—plus extended long-wave and ultra shortwave bands

G-E Lo-note Compensation

G-E Noise-Control G-E High- and Low-Speed Station-Finder G-E Sliding-rule Toning-

Scale G-E Precision-tuning Indlentor

G-E Shadow-band Tuner

twang that clouds reception.

And these sturdy metal tubes are enduringly strong . . . giving you performance invariably brilliant throughout a long and active life.

A radio always at "Concert Pitch"

Sensational as it is, the metal tube is but one of several great G-E Radio features.

There's a finer, more stable speaker-sired in the "House of Magic"... a speaker so supremely sensitive that speech and music now come to you

clear, mirror-true.

And there's the new and amazing Permaliner, sealing out those twin enemies of distant reception-moisture and dirt. Keeping the set at "concert pitch" over a long and brilliant career.

A sentinel out of "The Arabian Nights"

In the heart of this new G-E Radio, you'll also find the Sentry Box . . . controlling as many as five separate broadcasting bands ... housing the most alert watchman in all the world! NEW METAL TUBES. small, efficient, long-lived . . . designed to meet modern broadcasting conditions, short-wave and long-wave alike.

A thousand and one radio waves rush in upon him ... all demanding entrance. But he permits only one wave to pass-the wave to which you are dialed!

See it! Hear it! Make comparisons!

Because of these features, the New 1936 General Electric Radio gives not only a new brilliance of performance... but a lasting brilliance that the years cannot dim.

It is now on display at your nearest G-E Radio Dealer'sin table models and consoles ... priced from \$34.50 up.

(Prices slightly higher in West, Mid-West and South. Subject to change without notice.)

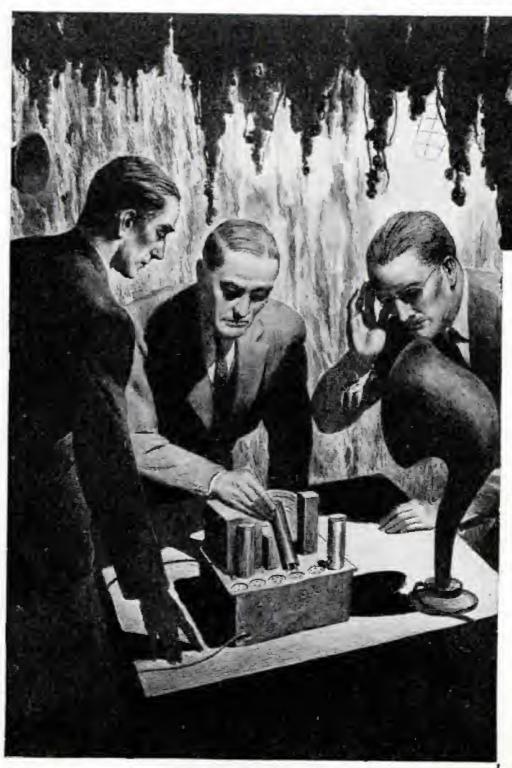
*Metal radio tubes, invented and perfected by General Electric, are made for General Electric by the RCA Mfg. Co. Complete receivers man-

ufactured by General Electric at Bridgeport, Conn.



The new 1936 GENERAL

... a new Radio Miracle!



Roam the world with these distance-defying sets... priced as low as \$34.50.



Model A-125—Twelve-tube superheterodyne, with five broadcasting bands. Completely equipped with new metal tubes. Walnut cabinet of neo-classic design.



Model A-63—Six-tube superheterodyne, with new metal tubes throughout. Two reception bands. Distinctive cubinet of walnut veneer,

MAKING MUSIC COME OUT OF A GAS-PIPE! An early step in a two-year search for a practical and efficient metal radio tube—conducted in the General Electric "House of Magic," A search that made use of a newly created alloy, Pernico...that utilized an ingenious method of welding that applies 75,000 amperes, for one-twentieth of a second, to fuse two metals into one! Such research development, typical of the "House of Magic," alone made the new metal tube possible...marking a milestone in radio progress.



ELECTRIC RADIO

Chinese Magic

(Continued from page 388)

the wand so the tack is turned away from the spectators. The magician lays the cord across the wand, at the left of the tack. Letting the ends dangle, he draws the back one downward, so it hangs below the front. He then winds the long end of the string three times around the wand, keeping to the left of the pin. At the end of the third turn, he loops the string around the tack. He then winds the string three times about the wand, but in the opposite direction and on the right side of the tack.

In his first turns, the magician winds the string away from himself; in the second series of turns, he winds the string toward himself. From the front, the wand appears to be girded six times by the cord. Actually, the string has been wound and unwound; all that holds it to the wand is the loop about the tack. Both ends of the cord are hanging below the wand; the magician ties them to the vase. The assistant twists the wand between his hands, revolving it away from his body. This action eliminates the coils, two at a time, until the full weight is borne by the tack. The pull of the cord snaps the tack from the wand.

The Chinese sword trick is also most astonishing. I use two assistants, one on either side, and each holds a large sword, blade upward. From these swords, I hang loops of flimsy rice paper; the two loops serve as a cradle for a stick of wood, about two feet in length. Taking a third sword, I make a downward stroke and cut the stick in half. The ends clatter to the floor but the rice paper loops remain uninjured. The secret is as surprising as is the trick itself. The stick absorbs the entire force of the sword blow; there is virtually no strain upon the paper loops.

The flying rice trick is a favorite among Chinese and Japanese magicians. The magician exhibits a large box filled with rice. He levels off the loose grains and covers the box with a silk cloth. When he removes the cloth, the box is empty. The magician calls upon the audience to return the rice. Dipping their hands in their pockets, the spectators are astonished to find quantities of loose rice.

This trick begins when the customers enter the hall. Courteous attendants usher them to their seats. These fellows plant small handfuls of rice in the pockets of the spectators. The box has a recessed bottom, with rice glued beneath. The magician exhibits the box upside down; hence it appears to be a box of rice. The loose grains add to the deception. The magician levels these off, so only the glued rice remains. Beneath the cloth, he turns the box right side up. Before the spectators can decide where the rice has gone, the magician starts them reaching into their own pockets.

One distinctly Chinese illusion is the decapitation trick, in which a man's head is cut off and later restored to his shoulders. During the filming of Harold Lloyd's picture, "The Cat's Paw," it was necessary to plan a spectacular Chinese illusion, startling enough to impress the hoodlums in the drama. I developed an illusion which was largely original, yet retained the full atmosphere of Chinese magic.

A headless dummy was placed upon a stretcher. A man was inside the dummy; his head extended upward through an opening in the dummy's chest. The next item was a plate, divided into two sections. The segments were fitted about the man's neck, like a collar, then locked so closely that the joints were not noticeable. Two Chinese carried the stretcher; and the burden gave the perfect semblance of a decapitated man whose head was resting in a salver conveniently placed upon his body. Those who saw the picture were highly amused when the trick was exposed in a later scene. There are certain illusions which never can be fully appreciated until they have been seen from back stage; and this is one of them. 702.

NON-DISSOLVING RUBBER GLOVE GIVES BETTER PROTECTION

Gloves now are being made of a synthetic rubber compound which will not dissolve in solutions that are solvents of natural rubber. The material is not disintegrated by hot or cold oil, caustics or alkalies and it is claimed it withstands the effects of sulphuric acid better than natural rubber. The same compound is being used for aprons, sleeves, suits and similar garments to give extra protection.

Industrial Troduct

WRITE YOUR OWN MOVIE SPECIFICATIONS There's a Ciné-Kodak to fit...



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Standard equipment includes builtin exposure guide, automatic footage indicator, two speeds, reflecting and eye-level finders.

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Eight Film makes two dozen or more sparkling-clear movie scenes, each of which lasts a full 10 seconds on the screen. And that's all you pay because the first low cost includes finishing by Eastman.

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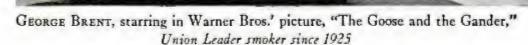
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I've smoked long enough to feel that I know something about smoking tobacco. But it wasn't until I tried my first tin of Union Leader that I discovered a dime will buy all the pipe pleasure that any expensive tobacco mixture can give.

Fine tobacco is fine tobacco no matter what the price tag reads, and the mellow, old Kentucky Burley in Union Leader is tops with me. So, why pay more, says I. And I save lots of nickels. (Great in cigarettes, too!)

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UNION LEADER THE GREAT AMERICAN SMOKE



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Half an Acre and Independence

(Continued from page 393)

per year-a chicken for every Sunday.

You will need a yard about fifteen by thirty-seven and one-half feet for your goats and a yard of similar dimensions for the chickens, a total of 1,125 square feet. Suppose you provide an area seventy-five by fifty-seven feet for your house and yard, or 4,275 square feet. This makes a total of 20,415 square feet, less than half an acre, in a plot seventy-five by 275 feet.

Feed for your goats and chickens, in addition to vegetable tops and table scraps, will cost you about \$65 per year. Preparing and planting the garden will probably cost \$15, plus nine dollars for supervision.

The yearly food requirements remaining to be purchased for a liberal diet, according to government figures, are 100 pounds of flour and cereals per person, sixty pounds of sugar per person and 165 pounds of meat, poultry and fish per person, from which is subtracted the 125 pounds of meat from the chicken yard. Suppose flour averages four cents per pound, sugar five and one-quarter cents, and meat, poultry and fish sixteen cents.

Then your total yearly outlay for retail purchased food, aside from occasional incidentals, is \$147.75 for a family of five. Add to this the feed purchased for your goats and chickens and the cost of supervising and planting the garden, and the total is \$236.75, or \$47.35 per person per year—less than a dollar a week per person for food. If you include the original cost of the two goats and the chickens-about \$100—your total for the year is \$336.75.

Let's be liberal and allow a whole dollar per day for food for five-\$365 per year. What about the cost of your half acre? Prices vary with location. Since you live in a city now, you probably are employed in a city, so you must select a half acre near transportation to your work. That means a plot on the fringe of the city, probably near or outside city limits, possibly with some improvements available. Suppose we estimate the cost of your lot at \$300. Some locations will be higher, some considerably lower.

By taking advantage of new building materials and methods, you can erect on this lot a five-room, all-metal, well-insulated and thoroughly substantial home for as little as \$1,750, including the cost of construction. On such a home you can obtain a loan from your bank or home loan company up to eighty per cent of the value of the house.

So if your lot costs \$300, you have an opportunity to erect on it a modern fiveroom house costing \$1,750, erected, for a cash outlay of \$350, or twenty per cent of the value of the house. Your long-term loan can be liquidated like rent over a period of years, your small monthly payments totaling about \$200 per year.

Now, let's recapitulate. The first year is your big expense year. Your lot cost an estimated \$300, the down payment on your house is \$350, the first year's payments on your loan on the house represent about \$200, and your food bill is \$365—a total of \$1,215. After the first year, food and home payments-about \$565 per year-are your big items of expense. If you add to this taxes, depreciation and upkeep costs, your total expense after the first year should still be less than two dollars per day for food and home payments. And remember that part of this money is going to build up your equity in your home each year.

Is such a project feasible for the typical urban family with an income of \$1,062 per year? It is if the family really desires a home enough to save the small amount needed the first year to launch the venture. After the first year, this average income provides a margin of between \$300 and \$350 above the total amount of food bills and home payments.

Once the lot is purchased, the ground itself can begin to pay for the house by reducing the food bills if it is made into a garden immediately. Thus the initial payment for the house can be augmented by the savings on food if the family income will not cover both the cost of the lot and the initial payment on the home.

As far as finding your half acre is concerned, just travel to the edge of your city and look around. A survey in the Chicago territory last year, for instance, revealed there are 254,000 arable acres within twenty miles of the downtown area. This represents more than half a million half acres, enough to feed 2,500,000 people. The same is true of almost any other American city.



Borrowed Eyes for the Blind

(Continued from page 363)

guide dogs, at street intersections, learn to watch, not the lights, but the traffic itself. They are taught to stop at doors and elevators with noses pointing to the knob or button, to lead their charges through revolving doors and to stop at steps and curbs until ordered to proceed.

The most difficult and most important stage of instruction is the third, when the dog learns disobedience. In this stage, the dog must master the why of her work—she must understand that she is providing the eyes for a sightless man. The instructor gives an order which is obviously impossible. Perhaps he says "forward" when a truck is blocking the sidewalk. Gradually the dog learns that it is the spirit of the command, rather than the word, that is to be obeyed. Thus she comes to think first of the safety of her charge and will ignore an unsafe order or figure out a solution.

When she has mastered all the fine points of obedience, guiding and the proper time for disobedience, she is ready to demonstrate her ability in the blindfold test. Her instructor, blindfolded, takes her on the street and uses her exactly as her future master will. When she can guide her teacher along strange streets, through busy traffic, around puddles, icy bits of pavements, ladders and manholes, she is ready to be introduced to her owner.

But her master is not ready to receive his guide dog until he has undergone a course of training and instruction himself. He comes to the same school from which his dog has graduated and spends a month there with her, learning through practice and instruction how to direct his dog and follow her guidance. The man gradually acquires confidence in the ability of his guide and from the time he is introduced to his dog, the two are inseparable.

The guide dog communicates information to her master through a U-shaped, semi-rigid handle attached to her harness. Her pace is fast, and any slackening of gait is felt through the handle, held in the master's left hand. For a step or any obstacle the dog stops until her master locates it with his foot or cane. If he finds steps, he commands "forward" and she pauses at each one until his foot has found it. At a curb, regardless of the command, the dog

waits until traffic is moving in the direction she is to take before proceeding. For pedestrians, trees and puddles, she leans away from or toward her master and he follows the gentle pressure or pull.

Never has a "Seeing Eye" dog led a master into a serious accident. As a matter of fact, those who have watched one of the dogs leading her blind charge often have observed that the man apparently was in less danger of accident than if he could see. One reason for this is that the dog does not take the chances which a seeing person might. She does not try to beat a light, she does not jaywalk and she does not dash into cross traffic. But she does make good time, for her pace is faster than that of the average pedestrian.

Harsh methods of instruction never are used in teaching or correcting these guides. Such methods would instill fear, break the dog's confidence in herself and rob her of her sense of responsibility. "Phui" is the strongest term employed when a guide makes a mistake during training. She is praised and caressed for each correct act rather than blamed and scolded when she makes mistakes. Thus the greatest reward her blind master can bestow is a friendly pat and a word of praise for a task well done. Like most humans, the guide dog thrives on flattery.

The working life of one of these guides is about ten years, and to breed and train one such animal costs about \$1,000, but the blind master who acquires one of these educated guides is asked by the philanthropic institution which breeds them to pay only \$150 for the dog, the equipment, and the man's tuition, board and lodging during the four weeks of instruction. Many make these payments in small installments over a period of years.

Not all blind persons, of course, can use these guides. Some are too old, some are too young, and some do not like dogs. However, it is estimated that if the dogs could be provided, there are more than 10,000 sightless people in the United States today who would benefit by them. Just as Braille has freed these people in the mental world, these educated guide dogs have proved their ability to free the blind in the physical world.

Ingram's cooler shaves explained by 2 COLD FACTS

7

Ingram's softens every whisker right down to the skin line.



2

Tightens the skin; prepares it for easy, scuffless shaving.



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The cool shaves men get with Ingram's are directly due to three special ingredients which help shavers these three ways—

1st, whiskers are thoroughly wilted but held erect for clean once-over shaving. 2nd, skin is smoothed and lubricated so your razor can glide in long even strokes. 3rd, the shave is cooled; no stinging or smarting.

Ingram's makes shaves so soothing you'll never need a lotion. And because it is concentrated it will make your shaves cost less! Three months of happy shaving from each tube or jar.



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INGRAM'S SHAVING CREAM

TRAINS WITHOUT TRACKS

(Continued from page 372)

roar of the motor is deafening. The driver's hands are in constant motion between the two gear levers and the air valve. Suddenly a light car swings directly in front of the tractor. The truck driver throws the air clear over. On the trailer and semi, brakes lock on the drums. Twenty tons of equipment slide to a crawl.

Outside the traffic zone the speed begins to climb. The speedometer steadies at thirty. The miles roll away. The sound of the motor stops conversation. The road looks level but the driver knows differently. With each change of gradient, imperceptible though it is to the eye, there is an alteration in the sound of the motor. Those subtle changes in rhythm have a meaning to the driver. If the motor is laboring, he shifts into a lower gear; if it is taking things too easy, he slips into over-drive.

At last the tractor swings from the highway and the trailer-train rolls sinuously into the yard of the harbor terminal. The tractor maneuvers for a moment, and by some black magic the rear trailer is spotted with barely a foot to spare on each side. The coupling and air lines are cut and the tractor again swings out and back, and the semi-trailer is spotted. Already the oil drums are being trundled into the light delivery truck which will take them to the waiting steamer.

The driver hands the harbor dispatcher his bills of lading and the dispatcher checks the train in. The teletype beside him reports the arrival of the oil drums to the city terminal.

The driver gets fresh orders and makes up a new train which goes to the company's third terminal, thirty miles away. Day and night the tractors keep on the move. They meet their schedules like clockwork. Each movement of the system is recorded on the teletype.

Occasionally a tractor breaks down but the delay is slight. Another is sent to take its place. No cargo is shifted. It is a matter of coupling on a new power unit.

If every railroad locomotive was permanently fastened to a string of freight cars, the iron horse would never have roamed America. Trucking companies have learned that vital fact. So a new type of heavy transportation has been born—trains that never have known rails.

PIGEONS OF THE MIDNIGHT PATROL

(Continued from page 378)

Homing pigeons from one to five years of age are usually faster in flight than old birds, but older birds are more reliable and consistent and the females are more dependable for long, hard flights than the males. Fanciers have discarded the old system of training birds to fly from each of the four directions of the compass during their instruction period. It has been learned that these birds are smart enough to come home from any direction without being trained to do so.

Pigeons are very intelligent and can learn many tricks if you have the patience to work with them. No better example of this can be found than in their ability to overcome their hereditary instinct to settle down at dusk—to keep on flying during the night, in storm and wind and rain. In case of storm these birds have been known to fly 100 miles out of their way to circumvent it.

What makes homing pigeons come home? It used to be thought that electrical currents guided them and this, it seems, is somewhat borne out by the assertion that radio waves affect the flight of homers. But if radio waves interfere with the homing instinct of these birds why do they not also interfere with the migratory instinct of other birds? No one seems to know the answer. The homing pigeon as a messenger carrier is very old. They were used to carry to the distant cities of Greece the names of the Olympic winners and for post service in the time of Napoleon. They brought word of this great general's defeat at Waterloo to the coast of Belgium where it was released by fast boat to England.

Our war pigeons are the result of the World War. It was then that the government set up its lofts. In all about 10,000 birds were used during the war. At the Aisne-Marne battle, the St. Mihiel drive and in the Meuse-Argonne offensive they were used effectively. But few birds were lost and the lives of many men were saved by the silencing of batteries on information of locations brought in by them. Messages are carried in small cylinders attached to their legs. To keep falcons, sent out by the enemy forces, from catching them, whistles are attached to the upper parts of their tails. These frighten away the birds of prey.





It's a crime to be SKIN

When Thousands Gain 10 to 15 Pounds This Special, Quick Way

EVEN if you never could gain an ounce—even if you seem "born" to be skinny and friendless—remember thousands have gained solid, naturally attractive flesh this new, easy way—in just a few weeks!

And not only has this new discovery given great numbers normal pounds, but also a naturally clear, radiant skin, freedom from indigestion and constipation, wonderful new pep.

Sensational new discovery

Scientists recently discovered that thousands of people are thin and rundown for the single reason that thousands of people are thin and rundown for the single reason that they do not get enough Vitamin B and iron in their daily food. Now the richest known source of body-building, digestion-strengthening Vitamin B is ale yeast. By a new process the finest ale yeast, imported from Europe, is now concentrated 7 times, making it 7 times more powerful. Then it is combined with 3 kinds of blood-building iron in pleasant little tablets known as Ironized Yeast tablets.

If you, too, are one of the hosts of thin people who only need these vital elements to build them up, get these amazing new Ironized Yeast tablets from your druggist today. Then day after day watch flat chest develop and skinny limbs round out to natural attractiveness. Constipation and indigestion from the same cause quickly vanish, skin clears to normal good looks, new pep comes you're an entirely new person.

Try it—guaranteed

No matter how skinny and rundown you may be, try these new Ironized Yeast tablets just a short time, and note the marvelous change. See if they don't build you up in just a few weeks, give you new health and new normal good looks, as they have thousands of others. Results are positively guaranteed. If you're not delighted with the benefits of the very first package, your money will be instantly refunded.

Only don't be deceived by the many cheaply prepared "Yeast and Iron" tablets sold in imitation of Ironized Yeast. These cheaply prepared "Yeast and Iron" tablets sold in imitation of Ironized Yeast. These cheaply prepared in the lowest grade of ordinary yeast and Iron, and cannot possibly give the same results as the scientific Ironized Yeast formula. Be sure you get genuine Ironized Yeast. Look for "IY" stamped on each tablet.

Special FREE offer!

To start you building up your health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mall it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Hody," by a well-known authority. Remember, results are guaranteed with the very first package—or money refunded. At all druggists, Ironized Yeast Co., Inc., Dept. 539, Atlanta, Ga.



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It is very easy to give your hair that rich, glossy and orderly appearance so

essential to well-groomed boys. Just rub a little Glostora through your hair once or twice a week—or after shampooing, and your hair will then stay, each day, just as you comb it.

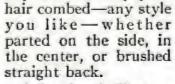
Glostora softens the hair and makes it pliable. Then, even stubborn hair will stay in place of its own accord.

It gives your hair that natural, rich, wellgroomed effect, instead of leaving it stiff and artificial looking as waxy pastes and creams do.

Glostora also keeps the scalp soft, and the hair healthy by restoring the natural oils from which the hair derives its health, life, gloss and lustre.

A bottle lasts for months

Try it!—See how easy it is to keep your



A bottle of Glostora can be bought for a trifle at any drug store and will last for months.



Glostora FOR THE HAIR

DOING IT BACKWARDS

(Continued from page 383)

a stick. At first it is packed and hard to stir but as you keep on the dry powder becomes fluffy and the faster you stir the easier the work becomes. Should you now pour the dry cement on the floor it flows out over a large area like water. This semi-frictionless movement of the dry powder is due to the small amount of entrained air that literally lubricates the dust particles. So this man built a pump, lubricated the dry dust with an infinitesimally small amount of air and pumped the dry powder over hill and dale. Last year almost a million tons of dry powder were pumped in this way.

In Alaska there are vast areas of gravel beds that contain free gold in the form of nuggets and dust. But the ground was frozen hard the year around and made mining so expensive that profitable operation was out of the question. They tried steam jets to thaw out the ground, and they tried hot water and then someone asked: "Why don't you run cold water over the ground and thaw it out?" They tried it and it worked—even better than hot water. Today a large part of Alaska's gold production results from this reversal of the natural order.

Many other industrial processes are only reversals of the older order. In the chemical industries we put in impurities to get out impurities. We pump sulphur from the bowels of the earth by melting the sulphur first with steam. We pump metals like they were water. The ingenuity of man finds its highest expression in this, the ability to reverse the natural order.

This little experiment will show you how simple it is to do the impossible. Try to make an ordinary cube of sugar burn with a match. The sugar just turns black and melts. Now touch the melted portion on your cigar ashes and try again. The sugar will burst into flames. So when you are stuck with your problem, keep trying—try anything. Try reversing the natural order.

(Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

FIGHTING FIRES WITH PHOTOGRAPHS

(Continued from page 357)

combustible materials, and the floor above, shut off by an all-metal covering, were introduced in court in fighting the claim.

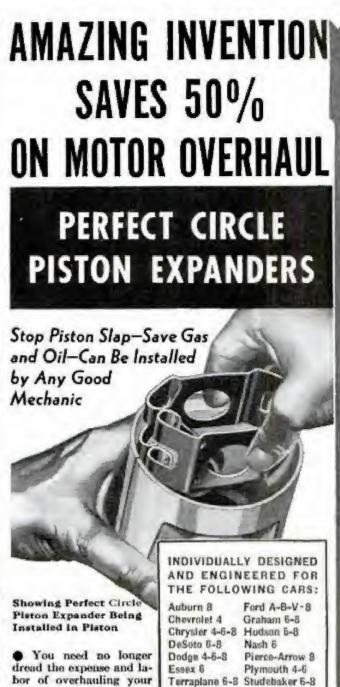
Three restaurant partners entered into a conspiracy to set fire to their business to collect the insurance. One of the trio saturated the fixtures with gasoline but allowed the fumes to accumulate before igniting the fuse and was knocked unconscious and perished in the fire. The photographs brought out the force of the explosion and startling details that sent the other two partners to prison.

Possessing a flair for details, McElroy often gets a picture that surprises even the most experienced insurance adjuster. While digging around in the smouldering ruins of a factory basement, he noted the stem of a gate valve was not protruding from the controlling wheel on the sprinkler system, indicating it to be closed. The valve indicators substantiated this and, to strengthen the point, he made a picture of the sectional valve marked "shut." These pictures were used to discredit testimony that the sprinkler was on during the fire.

Fire pictures also save insurance companies thousands of dollars where unscrupulous merchants try to drag undamaged stock through mud and water to collect the insurance. Pictures made at the time of the fire in the store where it occurred or in adjoining ones that might claim water losses helped to discourage this practice.

McElroy operates with all the speed and efficiency of his newspaper contemporaries. He got pictures of the Chicago stockyards fire, making a shot of its originating location six minutes after the alarm box. had been pulled. It was used in the official report of the board of underwriters. His most dangerous shot was made in an Indiana electrical substation when he had to climb around some 132,000-volt transformers to get a shot of a coil that had broken down electrically. The flooring of a two-story house gave way under him once but he escaped injury. On another occasion, the explosion of his flashlight powder brought part of a crumbling brick wall down but he jumped to safety.

The only trouble, McElroy says, is that fires today are not as interesting as when they were just a hobby with him.



bor of overhauling your motor. Perfect Circle motor reconditioning gives you new-car performance

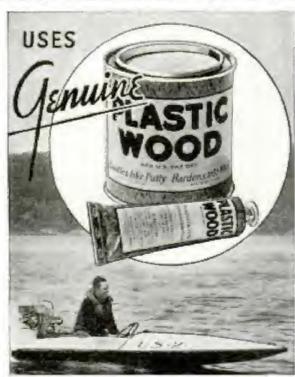
and economy, at HALF the cost of the old-style overhaul! After 20,000 or 25,000 miles, aluminum pistons usually are worn and distorted-no longer deliver maximum efficiency. Simply install Perfect Circle Piston Expanderspiston slap disappears—pistons are restored to their original shape and fit-are good as new. No cylinder resizing-no new pistons . . . You'll want new Perfect Circle Piston Rings,

Whippet 4-8

too. Oil pumping will stop—you'll have new-car pep and economy—and save 50% of regular overhaul cost! Any good mechanic can install Perfect Circle Piston panders and Rings, Mail coupon for further information.

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If your dealer cannot supply you, order direct. HULL MFG. CO., Box 245-D, WARREN, OHIO

BILLIARDS-AND HOW TO PLAY IT

(Continued from page 367)

"A" course is the result of left-hand English; "B" when no English is used, and "C" the result of English on the right-hand side. If the cue ball is twisting, it will naturally throw the object ball to one side.

Combinations are more complex. In the left figure on page 366 combinations with balls frozen and spread apart are indicated. The lines show you where the point of contact is on each ball on shots A and B. For a frozen ball combination, shot C explains the direction the ball takes according to where you strike the first object ball. The two object balls are lined straight for the edge of the pocket. No English is used in any of the variations of this shot. If you hit the first object ball one-fourth full to the right, you will force the ball you intend to pocket into the side rail. When you hit the first ball center, the second one goes straight to the edge of the pocket as shown by line two. To pocket the ball, hit just a trifle to the left of center. Hitting one-fourth full to the left will cause a miss as shown by line four.

NOISE TREATMENT FOR MILK MAKES IT DIGEST EASIER

Milk is affected by noise, and experiments at the University of Pennsylvania have demonstrated that it can be made more digestible by a sound treatment. Dr. Leslie A. Chambers of the university caused a thin stream of milk to flow over a heavy steel diaphragm while it was made to vibrate strongly. The mechanism was similar to the type used for submarine signaling. Its lowest vibration rate was 360 cycles a second, the pitch of F-sharp at the middle of a piano keyboard, and the highest 3,000 cycles, three octaves higher. The sound caused the milk, when acted on by stomach pepsin, to form a soft, easily digested curd while milk normally formed a hard curd. The experiments developed a simple mechanical method of making softcurded milk.

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S K F Ball-Bearing Head 36" Between Centers 100 Lb. Weight

A real master wood-working lathe, with

A real master wood-working manner, which you can do work to be proud of.

Very heavy construction of seasoned cast iron. Bed, 50 inches

Very heavy construction of seasoned cast iron. Bed, 50 inches

Very heavy construction of seasoned cast iron. Bed, 50 inches long, cross-braced every 5 inches, is absolutely rigid. Ways are integral with bed. Extra heavy, wide headstock. Hollow steel spindle, threaded both ends, lets you turn large diameters (table tops, etc.) over the end of the bench. Speeds 700, 1300, 2300 and 4000. SKF ball-bearings both sides of spindle drive william. Matter than he manufact aither halve are back of lating. Motor can be mounted either below or back of lathe. Dillery. Hand tool rest 12' long.

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For dividing, fluting, etc., on your larbe, there is no indexing mechanism consisting of 60 holes in the face of the spindle pulley, in which engages a pin which esca through the hendstock. You can divide accurately into any number of sections divable into 60.

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Eels, Mipk, Muskrats, with our new folding galvanized STEEL WIRE TRAP, Write for our FREE TRAP OFFER and Bargain Cat-

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We asked him the other day how he did it. and this is what he said (with certain modifi-

cations of expression):

"This is a tough job in which to make a living. The only way I have of getting cash is with this cab. In spite of slim pickings, I'll bet I pay more for oil than most cabbies; but it's worth it, because I found out long ago that repair bills can eat up the profits,

"I've used Quaker State Motor Oil for years. Hear that motor? Well she won't turn over more than 45 on level ground any morebut, boy, I won't trade her in until the body falls apart. She's one sweet engine.

"Believe me, I've got to keep on the job and out of the repair shop-and I know

Quaker State helps me do it."

The problem of keeping the motor car ready to run at any and all times confronts every owner. A large group of experienced motorists has discovered that the regular use of Quaker State Motor Oil and Superfine Lubricants is a practical and economical way to accomplish this. If you would like to enjoy this same satisfaction in owning a car, start today to use Quaker State. Quaker State Oil Refining Co., Oil City, Pa.

"First choice of Experience"

QUAKER STATE MOTOR OILS

35¢ per quart

When writing please mention Popular Mechanics

Million-Milers of the Air

(Continued from page 405)

United States, flew the inaugural passenger trip of Stout Airlines from Cleveland to Detroit and has 12,000 hours in the air.

Charles Peeples is an old army flyer who turned mail carrier. Shoving north from Dallas a few years ago in a mail plane, he encountered bad weather as he neared Oklahoma City, Land visibility dropped to zero and his retreat was cut off. He knew he was in the vicinity of Oklahoma City but the fog prevented him from landing, so he stayed aloft and flew by instruments until his fuel was nearly gone. Those were the days before radiotelephones and radio beacons, but the ground crew at Oklahoma City heard his engine and dotted the airport with all the flares they could find. Peeples decided to make one more attempt to land, then bail out. Watching his instruments like a hawk, he descended until he sighted flares through the fog. Much to his surprise he set down in the center of the airport.

Heber Miller, another million-miler, and his single-engine mail plane, had a less thrilling but more amusing experience with fog on the west coast several years ago. Miller was flying mail from Portland to Los Angeles and arrived at Vancouver airport, near Portland, one morning to find the field effectively masked by fog. A telephone call to a weather station on a high elevation near Portland brought information, however, that the top of the fog was only 1,000 feet above the ground. Miller decided he could take off, climb over the fog and proceed on his way.

He taxied out on the field to line himself along the runway for the take-off. The fog was so heavy, however, that he lost his sense of direction and soon stopped to get his bearings. The ground crew started after him in a truck but soon they too were lost in the murk. For the next hour the ground crew hunted aimlessly for Miller or the hangar and found neither. Miller, meanwhile, sat in his cockpit with his motor idling, occasionally shouting for some help from the ground personnel. Then the fog suddenly lifted, revealing Miller and his ship at one end of the runway and the ground crew still wandering about at the other end.

Richard Lee Dobie boasts more hours of

flying exclusively with United than any other pilot. His total is 8,000 with this line and 2,500 more hours before he joined the air-mail service. In his own estimation, his prize accomplishment occurred many, many years ago.

"I once led a formation of 105 'Jennies' at Kelly field," he explains. "In those days that seemed to me to be a whole sky full of airplanes. Today all I can think of is the immense amount of baling wire in such a mess of ships."

While the million-milers are the aces and rate as the veterans, the other pilots on the line boast air mileage ranging from just under the million mark to a little less than half a million miles, the average for all United pilots being 7,000 hours.

The pilots today have much easier jobs than were the lot of those first mail flyers, as any million-mile pilot will tell you. Let's let Jack Knight, who participated in that first day-and-night flight fourteen years ago, compare his flight then with a trip over the same route today.

"On that first night flight," says Knight, "I flew a single-engine DeHaviland equipped with just a few instruments. I had no night-flying apparatus, no radio, no directive beam, no airway lighting.

"Today I fly that same route in a twinmotor transport with two 550-horsepower engines, each capable of sustaining the plane in flight. In the cockpit are more than a score of instruments and devices to make navigation a science instead of a guess. I have powerful landing lights and flares in case I want to come down on one of the scores of emergency fields dotting my path. Instead of bonfires and flares, there are signal lights and radio beams. Instead of being isolated, I talk by radiotelephone with ground stations whenever I wish. I can't get off the course because the radio code signals keep me headed right. I know what the weather ahead is before I start and if it changes after I leave the ground, I get reports by radio.

"It may have been a lot more exciting to fly in the good old days, but I'll take things as they are today in preference to the good old days any time. And so, I guess, will the passengers, in the comfortable cabin, who ride with me."

Measurements 300 times finer than a human hair

EVEN though automobile parts are produced by highly developed methods on special machines there is only one way to insure their accuracy. That is by careful inspection.

For the inspection of Ford parts many of the gages used are of the amplifying type with each graduation on the dial indicating one ten-thousandth part of an inch. The precision of the parts can be no greater than the accuracy of the gages used to inspect them. Because of this all Ford inspection gages are checked by Johansson Gage Blocks—the world's standard of measurement and the most accurate system known.

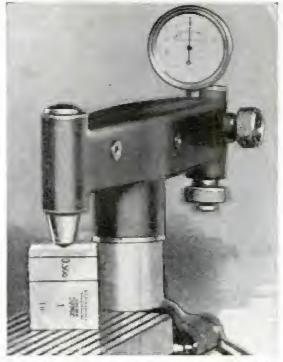
These gage blocks are accurate within a few millionths of an inch. It is possible to measure with them in hundred thousandths of an inch—that's approximately 300 times finer than a human hair. They are manufactured by the Johansson Division of the Ford Motor Company and are used by scientific laboratories and all industries where precision is a requisite.

Many of the tolerances now held on Ford parts were considered impossible for large production until just a few years ago. At that time limits of one-thousandth of an inch were considered close. Many Ford limits have been cut to one-tenth of this. Piston pins and piston-pin holes are but two examples where tolerance is within one ten-thousandth of an inch.

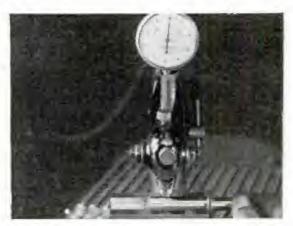
Holding to such close tolerances increases costs because all machines and tools must be kept in first-class condition to produce parts that will pass the rigid Ford inspections. In spite of this, the price you pay for Genuine Ford Parts is consistently low.

There is only one standard of limits established for Ford parts regardless of whether they are for production or for replacement. That's why you can depend on Genuine Ford Parts to fit as accurately and function as efficiently as the original parts.

FORD MOTOR COMPANY DEARBORN, MICHIGAN



This shows how the accuracy of an Amplifier Gage is checked with Johansson Gage Blocks.

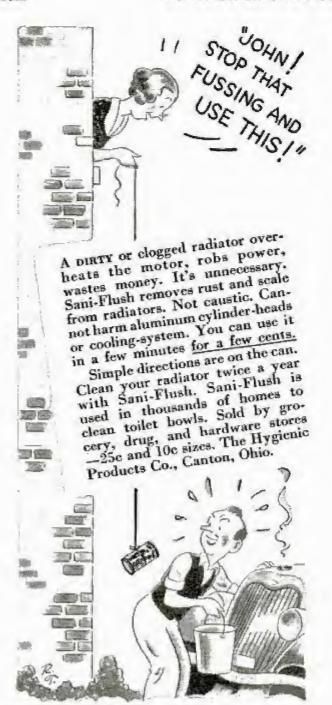


An Amplifier Gage being used to inspect Waterpump Shafts,



Special Amplifier Gages are used to inspect Connecting-rad Bearings.





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WHAT'S NEW IN THE MOVIES

(Continued from Coloroto Section)

skydrop, from the exterior, looks like an enormous tent surrounding the entire set. It furnishes the "sky" against which "outside" shots are made. Often the lower parts of these drops are painted into backgrounds, perhaps of a city, a country skyline, mountains or the oceans with ships. In front of the painted background drops are placed silhouettes of painted canvas stretched over light wooden frames to blend foreground and background and to give perspective. These silhouettes may be in the form of ships, office buildings or whatever may be required to carry the scene into the distance. In the Hawaiian set in "Flirtation Walk," palm trees only eighteen inches high were used to obtain the effect of distance. And in "Man's Castle," a silhouette of New York's skyline and a miniature Brooklyn bridge, with tiny electric trains running across it, combined to give the effect that squalid shacks really lay in the shadow of Manhattan.

In one picture, a man's head had to be transformed gradually and convincingly into that of a donkey. It was done by making a plaster cast and then life-size molds of the actor's head to which various features of the donkey were added by degrees. At each step, liquid rubber was blown on the casts or molds and when it dried, rubber masks were made representing the various stages. Finally the donkey's head was ready on a mold that fitted the actor's head. It was set with teeth and equipped with springs to work the lips and ears as the actor talked. A series of springs and saddles did the trick, one saddle fitting under the player's chin and two more at the corners of his mouth, with strings leading to weights and springs that operated the jaws and lips of the donkey head.

Supplying black fog was another problem encountered in "A Midsummer Night's Dream." Already the fog machine had been devised to blow an extremely fine mist, but it was so fine that no coloring would show. The solution was to rub a mixture of vaseline and lampblack over an extra lens and shoot through it.

So rapidly do new developments occur in the movies that little effort is made to patent the inventions of the technical departments. Instead, the experts are always preparing for new problems.

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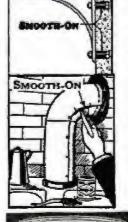
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This Girl Is Weighing Each Paste Center Carefully Before It Is Approved for Use

for making rubber golf-ball thread from the natural milk of the rubber tree. The company claims it is the first real advance in the process of manufacturing rubber thread since it was originally developed 100 years ago. The liquid rubber milk is forced through a nozzle into a coagulating bath which solidifies it. It is then dried and cured and is ready for use.

The covers of golf balls are made of either tjipetir or balata-both forms of rubber tough enough to take a lot of punishment and resilient enough to transmit the liveliness of the thread underneath.

A ball is in contact with the club head for one-five-thousandths of a second and in the cover markings of the standard golf ball designed by the ballistic experts there are 336 recesses. As the ball is leaving the face of the driver its traveling speed is approximately 167 feet per second. Mathematicians have figured the odds against making a hole-in-one are 107,510 to one, but Mike Brady scored two holes-in-one during one round at Buzzards Bay some years ago and another man made two successive holes-in-one in 1921 on a golf course at Newport, R. I.

FARMING BY MAGIC

(Continued from page 343)

A new and increasing theme in most types of modern farm tractors is the use of rubber tires in place of metal wheels or lugs. Machinery manufacturers name several reasons for the change-low-pressure tires grip more dependably upon more types of loose soil; to gain the necessary traction rubber tires do not compress or roll the soil, the equipment can be driven on roads and pavements without legal violation; tire replacement is not expensive because in field use the tread is not worn by skidding as is inevitably the case on hard-surface driving.

There is also an outstanding tendency toward fewer and sturdier parts for farm tractors. Costs continue to be cut by feeding with cheaper fuels. Steering gears are becoming as easy to operate and as efficient as those of the best automobiles. Four forward speeds have come into vogue. Oil and dust filters, force-feed lubricating systems, automatic oilers, crankcase ventilators, hydraulic power lifts, differential brakes, mufflers and changeable wheel rims varying with traction needs are becoming routine features of the once noisy farm tractor.

American mechanical genius continues to make rapid strides in the harvest of corn, our three-billion bushel crop. There is the automatic corn picker, capable of picking and husking from ten to twenty acres of corn a day. This is strictly a oneman outfit. A tractor draws the harvester and the wagon or truck beside it. The new corn binder cuts and stacks from ten to fifteen acres of cornstalks a day. Powerdriven blades cut the stalks about a foot above the ground, automatic bundle-carriers and elevators load them into accompanying wagons or trucks or drop them in uniform stacks. The automatic stalk converter, a sort of lengthy and glorified lawnmower, hitches behind the tractor and cuts stalks, stems or other crop litter left in the field after harvest into fine bits, which decay and therefore save annoyance in next season's plowing.

Three men operating the new types of mechanical corn shellers can shell corn grain from the cobs at the rate of 125 to 200 bushels an hour. Corn ears are fed into the machine by gravity, and the ma-

(Continued to page 135A)

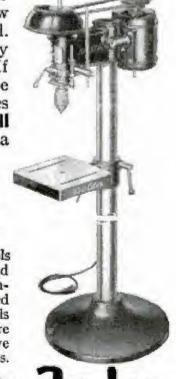
Soon.. New "DELTA" **Tools for Woodworking**



Delta engineers continue their steady year after year development and pioneering of new tools and new improvements in the motor-driven equipment field. Important announcements will be released shortly that will be of great interest to all Homecrafters. If you are contemplating additions to your shop-be sure to see the 1936 Delta line which includes Circular Saws, Jointers, Scroll Saws, Drill Presses, Band Saws, Routers, Lathes, and a complete assortment of attachments.

1936 Catalog Will Be Out Shortly

Within a short time the 1936 catalog of Delta quality tools will be off the press. It is crowded with photographs and information about the new line of 1936 Delta tools. It contains much valuable information that every man interested in wood-working tools should have. It shows how Delta tools are built to stand the grind of production work, and yet are so low priced as to be within the reach of all, how they save time, money and labor-and quickly pay for themselves.



NEW BOOK for Woodworkers

32 page book "Practical Delta Projects"-crowded with new and "out of the ordinary" things to make-with numerous working drawings, pho-tographs, and easy-to-understand illustrations, Simple, complete instructions make every project easy to follow. Every woodworker should have this book. Send only 10 cents ith coupon, Book and 1936 Delta catalog, will be mailed postpaid.



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FARMING BY MAGIC

(Continued from page 132A)

chine shells the corn, cleans off chaff and lint by means of power blowers, and by means of miniature elevators stores it in bins or cribs.

We are applying similar harvest skill to our old Irish stand-by, the potato, which is by far the greatest American vegetable crop. Anyone who has ever lived on a farm knows that potato digging by hand and hoe is hard, hot work, Nowadays strong, impersonal machines do the work,

Our leading vegetable crop also has the benefit of the automatic potato planter, a special version of the gravity seed drill, which prepares the seed row, drops the seed potatoes at desired intervals, drops a helping of fertilizer near each seed, then covers the seed, all with reliable accuracy and at a work speed ranging from fifteen to twenty-five acres a day.

On the whole, the new magic of farming is a fast magic. Reliable rumor says the coming year will see many new wonders offered for the convenience and profit of our great wonderlands of farms. There is more and more reason to believe that you or I may live to see the day when farms can be operated by pressing buttons; when crops will grow in winter from stored sunlight; when a well-run farm will be as efficient mechanically as a well-run factory

QUICK WAY TO MAKE MIRRORS FOR GIANT TELESCOPES

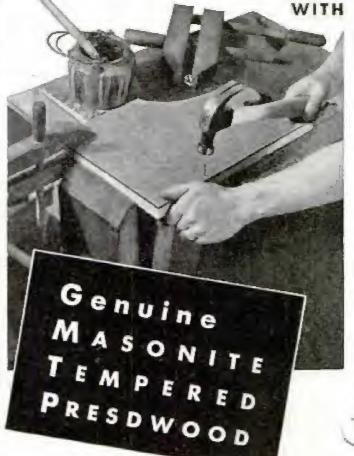
Instead of rubbing and grinding a spherical mirror for months until it attains the parabolic shape necessary for telescopes, a new method deposits aluminum in just the right places to change the sphere into a parabola. The amount to be deposited can be calculated in advance. If something goes wrong, it is only necessary to remove the aluminum and repeat the process, instead of re-working the whole mirror. The process eliminates much time and labor in the preparation of mirrors for giant telescopes, in addition to reducing the cost considerably. To grind the mirror of the 100-inch telescope at Mt. Wilson observatory, three men labored five years.

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

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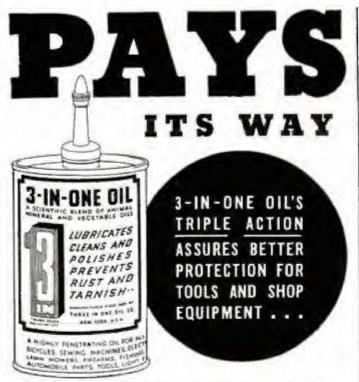
3 Tempered PRESDWOOD is a permanent material. Moisture-resisting, it will not warp, chip, split or crack. Joints and sides stay fitted exactly according to specifications. It requires no finishing treatment. Tempered PRESD-WOOD'S own natural warm-brown surface makes a beau-tiful final appearance. But it can be varnished, lacquered, painted or enameled with standard applications, if desired. Mail us the coupon below for free sample of Masonite Tempered PRESDWOOD to experiment with in your own shop, and for additional literature. Genuine Masonite Tempered PRESDWOOD and In-sulation are ideal for home-building and remodeling. Easy to finance under F.H.A. Ask your Masonite dealer.

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> TRANSPARENT WATERPROOF



GAR WOOD'S MYSTERY BOAT

6 387

(Continued from page 409)

had to be a different hull and a stronger one than ever had been built before. Thirty-eight feet long and ten feet and eight inches wide, with four heavy stringers of Oregon spruce running the full length of the ship to serve as stout engine beds, Wood knew he could never spring the bow and bend it to get the proper planing angle at the forward step. Having figured the weight to be carried, Wood built the boat with a variable forward plane, one he could add to or subtract from. In trials he did this until he found its best planing angle.

That was the Miss America until this year when the horsepower was increased from 6,400 to 7,200, an engineering feat achieved by increasing the gear ratios in the superchargers from 2.25 to one to 2.45 to one. Again it meant adventuring into the unknown and this time it was highly dangerous. For months the four motors, one after the other, were on the dynamometer in the Packard plant. Each day the engine speed was boosted a little higher. A new and highly volatile fuel was being used, and it was so explosive that special blowers had to be built to carry off the fumes. Finally new superchargers, their rotors whirling air and gas into chambers and from there into the manifolds leading to the cylinders at a pressure of ten and one-half pounds each-or a total of fortytwo pounds pressure-were making 6,400 revolutions a minute when the engines were wide open at 2,600 revolutions per minute. When that performance was attained the dial on the dynamometer registered a horsepower pull of 7,200, but not before there had been several backfires that sent great sheets of flame across the room. Then the motors were placed in the hull and Miss America X was shipped to Florida for its recent record trials.

What will be the speed of Miss America X if pressed to the ultimate of her 7,200 horsepower? No one knows. The boat has not been driven anything like her limit and probably never will be.

"I will not drive it to the limit unless I have to—either to win a Harmsworth race or, if my record is broken, to regain it for this country," Wood has said.

Thus Miss America X remains not only a miracle but a mystery boat.

New Invention **Revolutionizes Home Heating** Costs Only 1/2 An Hour!



An Ohio inventor, J. C. Steese, of Akron, has hit upon a discovery which revolutionizes heating costs in every home. It replaces old-fashioned stoves, and even furnaces, Gives a room full of healthful heat for about 15c an hour. Is portable. Makes and burns its own gas. Absolutely safe. Now offered on a 30-day trial right in your home, at our risk!

CHEAPER THAN COAL! NO SOOT...NO ASHES!

Mr. Steese calls his invention the Diamond Radiant Heater. Although amazingly inexpensive, it is a complete heating unit and works perfectly, even in zero weather. You adjust it instantly to get as much or as little heat as you want. No need in chilly Spring or Fall to keep expensive, mussy coal fires going day and night.

You get heat instantly with this invention, with no waste, no fussing, no waiting, as with coal or wood. There are no wires, no tubes, no attachments to fuss with. In 60 seconds after you get it, this invention starts producing clean, healthful "radiant" heat for you, almost like heat from the sun itself.



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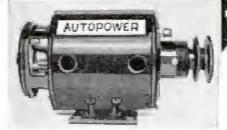
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INEXPENSIVE METAL LOCATOR

(Continued from page 423)

sponse to metal bodies is all that could be desired. The location of battlefield relics, and valuables buried during the Civil war, are interesting possibilities within the reach of this portable low-cost unit.

The instrument is housed in a sheetmetal case, the dimensions of which are given in Fig. 1. Narrow strips of the same metal are bent to form the angle brackets for the bottom and corners. The metal top panel, with the tubes and other parts fastened to the underside, is held in position by means of a metal clamp. The wood uprights at the ends are supported by means of machine screws and short metal bushings. A hand grip, consisting of a metal sleeve prevents body-capacity effects.

The circuit consists of a shielded oscillator for the exploring coil and a regenerative detector for the monitor stage which can be thrown into oscillation easily. Two type-30 tubes are employed in each of these stages, with a single 30 tube in the audio amplifier, as shown in Fig. 3 and the simplified wiring diagram, Fig. 8. All of the parts should be arranged and mounted exactly as indicated in Fig. 8. The batteries fit into the bottom of the case and all connections are shown in Fig. 4. Winding data for the monitor coil are given in Fig. 5, and the exploring-coil windings are detailed in Figs. 6 and 7. The sectional view of the wood rim shows the spaced windings held in position with collodion. A layer of insulating tape is placed over these windings. The copper-screen shield and a final wrapping of friction tape are applied after the cable connections have been made. A complete material list with further operating data can be obtained upon application, without charge.

To place the instrument in operation, use the test stick shown in Fig. 2; the copper ball is from a flush box. Adjust both controls until a whistling note is heard in the phones, then re-tune the monitor control to zero beat, or until no signal is received except when the copper test ball is brought within the field of the exploring coil. An enlarged blueprint of the layout and wiring diagrams is available; those who wish it should specify blueprint R-213. When operating in the field, make frequent checks with the test ball to be sure that

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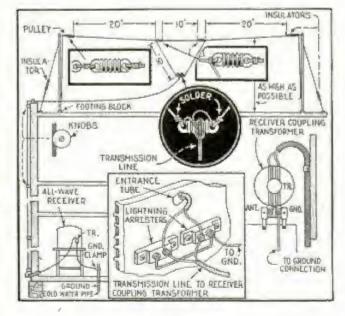
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ANTENNA INSTALLATIONS

(Continued from page 424)

so located that the lead-in, or transmission cable may be brought down conveniently at right angles from the center of the antenna. Most standard kits for this system include antenna wire, insulators, transmission cable, and the necessary coupling transformers. A single-receiver installation is shown in Fig. 6. Complete instructions accompany each kit as various makes differ in minor details.

Anyone can erect a doublet antenna system of this description with very few



tools. The dotted lines on the flat top portions indicate a cage type of construction which is entirely optional. The antennacoupling unit is connected in the center of the flat top and the insulated transmission cable line is brought down to the set coupler mounted in or near the receiver.

Fig. 7 shows a multiple system for a number of all-wave receivers which is suitable for use in radio stores or small apartment houses. The 500-ohm resistor, indicated in the diagram, should be used in each top leg to prevent reaction between sets when more than five are used at once.

One of the least expensive and simplest doublet systems possible is illustrated in Fig. 8. Lynch antenna wire and "Giant-Killer" transmission cable are employed. The "V-Doublet" antenna, also supplied in kit form, is detailed in the above sketch. This system is based on discoveries made by General Electric engineers in designing the antennas of short-wave stations W2XAD and W2XAF.

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TELEVISION FOR MILLIONS

Continued from page 322)

movie film with a motion-picture camera, This film is then developed in a "dark room" incorporated in the equipment. Instead of winding the film on a reel as it is taken, it passes into a developer, then a washer, then a fixing bath, and then another washer, the process being continuous as the film is exposed.

As it leaves the last washer, the wet film is projected onto a screen and picked up by the television camera, being transmitted two minutes after it is taken. It is unnecessary to print it, as in motionpicture projection. The third process utilizes the "telecine," a device through which movie film or still scenes are transmitted. By this method the film must be developed and printed, as for movie projection. The telecine has a device for picking up and transmitting the sound track of talking pictures at the same time the picture is transmitted. The Baird company is affiliated with a British film company and the actors and directors of the movie company provide many of the programs.

One Berlin station is transmitting daily programs, mostly speeches, the receiving sets picking up both the words and the features of the speaker. Ten other stations are being planned for Germany, and receivers are being built to sell for about \$200. The different stations are to be connected by wireless and cables which can be used for telephone traffic when not employed for television. The receivers are equipped with cold-cathode tubes which project the received image on a screen set up in the cabinet.

David Sarnoff, president of Radio Corporation of America, has announced that \$1,000,000 will be spent in building a transmitting station in the New York metropolitan district, in constructing receivers and in program service. Transmission, in the beginning, will be limited to a radius of about twenty-five miles but this will make television available to several million New Yorkers. The images are expected to show ten times the detail of crude experimental pictures of a few years ago. Because of the high cost of the many wires necessary to transmit television, it is expected that its general development must await the building of transmitting stations to serve limited areas.



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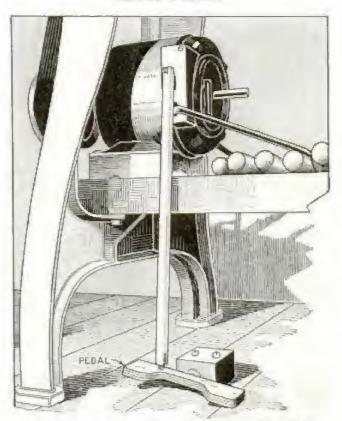
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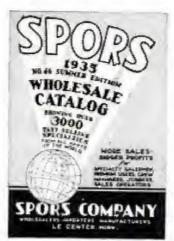


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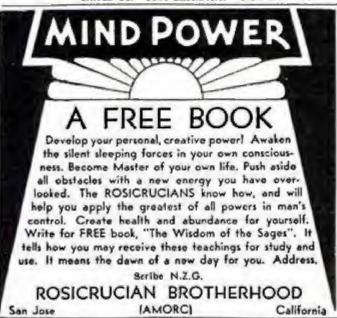
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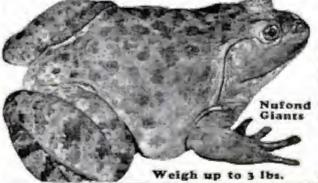


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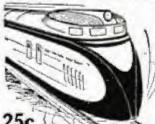
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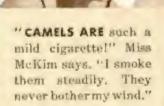
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